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Editor

A. KATHERINE BERGER
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Photograph by Alfred M. Bailey

A CITIZEN OF THE GULF COAST

The brown pelican is the largest of the nesting birds of the Gulf Coast, and its island cities are crowded with a dense population. When the downy young are quite small, the parents stand upon the edge of the nest to protect the babies from the direct rays of the sun

—See "Wings Along the Gulf"

VOLUME XXIX

NATURAL HISTORY

NUMBER THREE

MAY-JUNE, 1929

WINGS ALONG THE GULF

Birds that Inhabit the Swamps and Islands of the Louisiana Coast—Herons and Egrets—Pelicans and Terns—Geese, Gulls, and Others

By ALFRED M. BAILEY
Director, Chicago Academy of Sciences

THE coastal marshes of Louisiana are renowned as the wintering grounds of our northern breeding birds; hordes of ducks and geese wing their way from tundra lakes and arctic shores to the low lands bordering the Gulf of Mexico and seek refuge on the wide-stretching savannahs.

Many wild life reservations have been set aside in Louisiana, and ducks and geese of many species find food and safety within their borders. Snow geese, their black primaries dark against the sky, are a common sight, and ducks often are so numerous that it would be impossible to estimate their numbers. Blue geese are in flocks of thousands, and their quavering calls may be heard for miles when the wind is from the right direction.

Last fall I worked the marshes at the mouth of the Mississippi River, making my headquarters on the property of Mr. Joseph Leiter. This is in the center of the wintering grounds of the greatest flock of blue geese in existence. The blue goose has a very restricted winter range, limited practically to the coastal marshes of Louisiana. It is difficult to estimate the number of birds, but this flock of geese, which was along the mouth of the Mississippi, numbered many thousands of individuals. I was so fortunate as to witness their arrival from their arctic breeding grounds, on October 25.

When we were chug-chugging down the bayou to our photographic blind along the shores of the Gulf, at nine in the morning, we flushed a flock of more than two thousand birds from the marsh. This horde went clamoring down wind to the mouth of Main Pass, where they rested in a great sea bend and acted as a decoy flock. We witnessed, in the next few hours, the most interesting flight of geese I have ever seen. From nine o'clock to four in the afternoon, at which time we left the blind, there was a continuous arrival of geese from the north. There were from one to three flocks in sight at all times, one flock following after the other over the same air trail, and the flocks averaged from 25 to 200 birds in each! They seemed to be calling to one another, the flocks in front guiding those in the rear.

Although Louisiana is famed for its

Photograph by Alfred M. Bailey

A HOME ON AVERY ISLAND

Many species of herons and other water birds are common here and, owing to the protection given them, are very tame. It has been Mr. E. A. McIlhenny's custom to haul branches to the shores of the pond during the nesting season that the birds may use them as nesting material

abundance of wintering birds, it also has an enormous avian population during the summer. The low marshes, mangrove swamps, and shell islands are the breeding places of thousands upon thousands of herons, gulls, terns, and other southern nesting forms.

The abundance of bird life along the coast is a lasting monument to bird conservation and to the men who caused legislation to be enacted for the preservation of our wild life. For it was not many years ago that feather hunting was at its height; there was a great demand for the plumes of the egret and the wings of the tern.

Boatload after boatload of hunters left the small settlements and scoured the shores for birds. They visited the heronries and shot the egrets as they were returning with food to their young, and they raided the colonies of the nesting terns and gulls, killing the birds by thousands. The dull boom of black powder could be heard from all sides, and the slaughter continued as long as a target was found.

The result was inevitable; the birds were practically exterminated. And then came legislation to prohibit the killing of birds for millinery purposes, and President Roosevelt set aside many small islands as breeding sanctuaries.

For a few years it seemed the conservationists were too late, but gradually colonies were formed, the birds were allowed to breed in safety, and now, after twenty years of protection by the Federal and State governments, Louisiana has a wealth of bird life unequalled by any other state.

It has been my privilege to visit most of the interesting places among the lowlands of Louisiana in company with Mr.

Stanley C. Arthur, director of the division of wild life of the State Conservation Department. The department has several patrol boats and many efficient wardens constantly on duty, but of more importance is the campaign which it has conducted to educate the people of outlying communities. The inhabitants of the coast are a kindly and, for the most part, illiterate people, who make their living by fishing and trapping; they live along the tortuous bayous that thread through the marshes, far from the center of civilization, and it was only through education that their coöperation could be obtained.

The nesting birds of these lowlands and of the islands lying in the Gulf of Mexico have always interested me. Offshore, to the northward of Mr. Leiter's holdings, at the mouth of the Mississippi River, are the nesting grounds of many thousands of "silver-winged" sea birds. I doubt if there is a like area in the world with a more numerous bird population. The little shell islands which a few years ago were barren of bird life, are white during the nesting season, with compact masses of terns, gulls, and skimmers.

A cruise over the shallow waters of this little bird world is a delightful experience. One season, Mr. Arthur and I started at Pass a'Loutre at the mouth of the Mississippi, and worked northward, visiting all the sand spits en route. It was June 1, and as we chugged through the pass late in the evening, we saw bands of pelicans stringing low over the water with slow, methodical wing beats. They were returning from their fishing grounds in the open gulf, and all were headed, like spokes in a wheel, toward the low-lying "mud lumps" which dot the waters well out from the main land.

Photograph by Alfred M. Bailey

A SNOWY HERON

The majority of these birds feed in the open marshes, often miles away from their nesting site, but occasionally a fisher bird may be seen stalking silently at the border of tangled growth, its wings reflected in the quiet waters

Photograph by Alfred M. Bailey

A PELICAN CITY

Pelicans in flight remind one of the reptilian-like birds of remote ages, for they assume grotesque postures as they launch awkwardly into the air, or as they sail above their homes preparatory to alighting

Photograph by Alfred M. Bailey

NEARLY FULL GROWN

These young pelicans were a clumsy lot as they sprawled awkwardly about, each one seemingly in the way of the others. They were usually tame, however, and made little effort to avoid a visitor in their midst

Photograph by Alfred M. Bailey

THE PELICAN CAFETERIA

Self service in is vogue at mealtime, and the young pelican with the most determination secures the lion's share of fish. The young are often so persistent in begging for fish that the adults often take wing to escape them

Photograph by Alfred M. Bailey

A GRAVE ASSEMBLAGE

Many of the young gathered in small parties and stood with great dignity upon the muddy shores. On occasion they have the bearing and solemnity of jurists drawn before the bar of justice, or of white-robed choristers

Photograph by Alfred M. Bailey

A COLONY OF NESTING TERNS

These are exceedingly tame birds and will often allow the photographer to walk within a few feet of them. Then, those on the outer fringe of the colony rise into the wind with the flashing of a myriad pearl-gray wings

Photograph by Alfred M. Bailey

A MAJESTIC SEA BIRD

Royal terns protect their young from the direct sun with drooping wings as they stand with crest erect and shriek their defiance to the world

The next day we visited these pelican cities and found birds in unbelievable numbers. Each island was crowded to capacity with great pouched, solemn-eyed tenants, and with hordes of wing-flapping, grunting, clumsy young, that stumbled over the uneven ground with great webbed feet splayed upon the heads of other youngsters too small or too slow to get out of the way.

As we landed from the skiff, all was confusion. Adult pelicans flopped overhead, making circles about their little island, while the large young formed into big bands and hastily swarmed into the water. We erected blinds that we might take photographs, and pry into the family secrets of the pelicans without their being alarmed. Scarcely had we concealed ourselves when a few of the parents dropped back upon the island; those with small "India-rubber" babies

were especially solicitous, and sheltered them with outstretched wings from the fierce rays of the semi-tropical sun.

The large downy pelicans were great beggars, and they pleaded for food from every adult in the vicinity, but they were usually received with vicious snaps of the strong beaks. The old ones were quarrelsome, and snapped bills at each other, especially when one would try to steal nesting material. The pelicans were so numerous that the material for nest building was at a premium, so, unless the owners held down their claims, other birds would steal the sticks with which they were made. It was amusing to watch a grotesque old pelican waddling unconcernedly along, until he came to an unprotected nest; he would grab a few sticks in his mouth, in spite of the protests of the young bird, and spreading his great wings, would lumber awkwardly into the air.

Photograph by Alfred M. Bailey

A LEAST TERN

When the adults alight near their babies, they hold their wings extended for a few moments and call excitedly with shrill, querulous voices

Photograph by Alfred M. Bailey

CABOT TERNS

The tern colonies are densely populated, each nesting bird owning as much territory as it can protect with its beak. Sparring with rapier-like thrusts of sharp beaks seems to be a way of passing time

Photograph by Alfred M. Bailey

THE AVERY ISLAND HERONRY

When feather hunting had nearly caused the extinction of the snowy egret, E. A. McIlhenny made an artificial lake on his estate and kept several pairs of herons captive during the summer season. These were liberated in the fall, and now the population of the colony is numbered in the thousands

An afternoon in a photographic blind on a pelican island is like a three-ringed circus; there is something going on all the time. The young pelicans which had paddled into the water on our arrival soon returned, and cluttered up the foreground so it was almost impossible to get pictures of other birds. Two, three-fourths grown, were a nuisance, for they seemed to be attracted by the lens protruding from the blind. They posed a few feet away, and refused to budge, in spite of our efforts to have them move along. Many old ones stood upright on their nests so that their shadows sheltered the small babies, and when a neighbor or a neighbor's offspring came waddling in the way, he was greeted with an angry snapping of beaks. Even the young ones would sit upon their heels and try valiantly to make noises with their rubber-like mandibles.

There seems to be no peace in a pelican city. There is a constant racket, a combination of weird sounds ranging from querulous caterwauls to elephant-like grunts. Most disturbances seemed to be caused by the constant begging of the young for food, and when half a dozen young pelicans, nearly full-grown, mobbed a parent bird for fish, there was continuous action. The young would thrust their beaks into the throat of the old one, in their anxiety for their suppers, and while one was being served the others whined as they milled about, stepping on each other's feet, and beating each other over the head with their wings. Near our blind was a nest of newly hatched young, black-skinned, naked fellows. When the old female stood alongside and opened her beak to feed one of them, the little pelican stretched to his full height and put his wobbly,

bald head into the mother's throat, until he was completely within the pouch.

After a day among the pelicans, we sailed northward over a rolling sea and dropped anchor at Breton Island. This was a favorite nesting place of the royal tern when Roosevelt made his cruise among the bird islands, but we found only a small colony, and none of the eggs had hatched.

Skimmers and laughing gulls rested upon the low bars, which were slightly awash with the rising tide; a pair of oyster catchers were upon a shell reef, their grotesque, orange-colored mandibles making them the clowns of the shore birds; while along the sandy, wind-blown beaches were many willets and Wilson's plovers. Nests of both species were found, the former in cuplike depressions in the wiry beach grass, and the latter upon the sand.

A willet staged a pretty show as she circled about us with drooping wings and cries of distress, flopping over the ground with all the appearance of a crippled bird. One of the men from the crew was completely fooled, and pursued the willet for a long distance until she gathered strength and took to wing. A Florida nighthawk was also flushed from under foot, and when we investigated, we found two protectively colored eggs in a slight depression in the sand. We marked the spot, and on our return had no difficulty in getting pictures of the nesting bird.

A few hours later we landed on Hog Island, a small shell heap with a tangled growth of wiry salt grass and low mangrove bushes. Louisiana and little blue herons were nesting among the thick growths, laughing gulls' eggs were found in the grass, and skimmers' and royal terns' upon the beach. I photographed the Forster terns where they nested upon floating masses of dead grass in the arm of a sea bend; they were beautiful little fellows, with forked tails and bright orange-colored beaks and legs. They were reluctant to return to their eggs and

Photograph by E. A. McIlhenny

THE SNOWY EGRET

This most beautiful of the marsh birds nests in colonies in dense growths of button bush and willow, building its frail nest over the water

Photograph by Alfred M. Bailey

THE YOUNG OF THE LEAST BITTERN

Buff-colored, skinny little fellows, they perch on their frail platform among the tules until danger threatens; then they quickly tumble headlong into the rushes, where they remain quiet until the alarm is over

young at first, but hovered over the blind, uttering monotonous, querulous notes; finally, however, one of them dropped behind a screen of mangroves, and then, one by one, the others settled alongside their nests with their immaculate, silver-colored wings upraised for a few moments as they took a few short hops. The downy youngsters had crawled into the shade of near-by vegetation, but when the old ones alighted, they gave low calls, and little, fuzzy bundles came tumbling from their places of concealment, and took shelter under the drooping wings of the parents.

Laughing gulls nested on a ridge a short distance away, the three large eggs being laid in rather bulky nests of sticks and grasses. The whole gull colony scolded overhead as I put up my blind, but after I was concealed, it was not long until all was quiet and life went on as usual. The bird I desired to photograph was reluctant to return at first, and stood behind a screen of mangroves for a long time, while I waited motionless with the camera ready. Finally, however, she climbed upon the nest and dropped upon her eggs before I could get a photograph of her standing over them. It was intensely hot, and the brooding bird panted and her body shook as she sat upon the nest, her mouth held open, and moisture dropping from the tip of her beak.

The next day we sailed over an opalescent sea to Grand Cochere, where we had found a great pelican colony the year before. The island was a foot under water! On Errol Island we found a great colony of sea birds,—Cabots and large royal terns. They were massed upon the gleaming shell keys in thousands, and their continuous screaming made it almost impossible for us to talk with

each other. We erected our blind in their midst and made many pictures. They were very quarrelsome and fought continually. The Cabot terns were particularly pugnacious and struck fiercely with their sharp-tipped beaks at the royals or their brother Cabots. The terns, like the pelicans, were very solicitous of their own young, but were extremely liberal with cuffs handed to their neighbors' children. They would peck the fuzzy little youngsters whenever they toddled into range, seeking shelter from the hot sun. The light was blinding, as it was reflected from the shells and the water, and the heat intense, and as there was no vegetation upon the shell of the nesting grounds, it was necessary for the babies to seek protection under outstretched wings.

The royal terns are strikingly handsome fellows, and remind one of turkey cocks as they strut about with crests erect and feathers ruffled. The Cabots are contrasted by their smaller size and dark bills, but they are able to hold their own in a world of quarrelsome neighbors. There was a continual going and coming to the island as sea birds left for distant fishing grounds, while others returned with small fishes dangling from their beaks. The old ones were so quick in feeding the babies that I was never successful in getting a picture. They would stand off with the fish held crosswise in their beaks, and heads held high to ward off the attacks of others, and then one would suddenly dart in and cram a fish down a gaping maw before I could register it. The beach was so low that one catastrophe had already occurred, for we found one place where a wave had washed over a thousand eggs in one great windrow.

At the north end of Errol Island we

Photograph by Alfred M. Bailey

THE LAUGHING GULL

While gulls nest in colonies, the nests are usually isolated and hidden from one another by a screen of wiry salt grass. They are most reluctant to face the camera

Photograph by E. A. McIlhenny

GUARDING THE NEST

Adult Louisiana herons are more aggressive than the small egrets in protecting their homes. On one occasion Mr. Bailey found a yellow-billed cuckoo which had been killed with a jab from a heron's beak, as the cuckoo was attempting to steal an egg

found another large colony of terns—about thirteen thousand, we estimated. The Cabot terns were the most numerous, and fresh eggs were scattered about over a large area. Inland, on the higher slopes among the dense stands of mangrove, was a colony of pelicans, and attending them was a flock of several hundred man-o'-war birds. These predacious old fellows make an easy living plundering the hard-working pelicans of their fish. There was also a small colony of Caspian terns along an exposed strip of beach, while working the water's edge were several willets and Wilson's plovers. We were surprised to find two knots in breeding plumage—sandpipers which should have been north of the Arctic Circle at that time of the year.

We cruised along the Chandeleurs the following day, occasionally taking soundings as we passed over low bars, but we did not land on any of the low, mangrove-grown keys, as there were few birds flying over them. Snowy egrets passed us on silent wing, poising overhead with their long necks outstretched, and an occasional Louisiana heron made excursions offshore to circle our boat, apparently out of sheer curiosity, but our time was short, and we did not care to investigate the Chandeleurs on that visit.

We headed for Free Mason Shoals, a great mangrove island with beautiful shell beaches, and a long sand spit that extended to the eastward. We saw oyster catchers upon the spit, and black-crowned night herons among the bushes. A colony of one hundred Caspian terns were on the highest part of the shell keys, nesting among the drift, while a couple of hundred royal terns were upon their nests closer to the water's edge.

There were several thousand laughing

gulls scattered among the wiry grasses, with fresh eggs in their nests, while of most interest to me was a colony of about seventy-five pairs of least terns. They flushed wildly when we came near, but I erected my blind upon the ridge where I found a few sets of eggs in little hollows among the gleaming oyster shells. The little "sea swallows" hovered anxiously overhead, their shrill, strident notes indicating their anxiety. When we were concealed, they began dropping to the shells, and in a few moments, what had appeared a barren mound was alive with downy youngsters.

The babies were so small, scarcely larger than golf balls, and so protectively colored, that we had failed to see them. They came tumbling from all sorts of places of concealment, from under shells or bits of driftwood, and many crawled within the shade of our blind for protection from the sun. When we lifted the canvas, several walked in!

The adults alighted within a few feet, and one was incubating an egg and sheltering two fuzzy youngsters at the same time; when we waved our hands from the blind, she would dart into the air with a quick stroke of the wings, circle about, and then alight, running to her nest with wings half lifted.

On a high beach near by was a large colony of skimmers, grotesque fellows dressed in black and white, with long slender mandibles, the lower one being much longer than the upper. They were incubating their four speckled eggs which were laid upon the bare shell. There were also many solemn, long-legged, gray-and-black youngsters, and they usually tried to escape by taking to water or dropping flat upon the ground, hoping their dull colors would conceal them.

The terns, gulls, pelicans, and skimmers are typical salt-water birds. We studied and photographed them to our hearts' content on this little jaunt—just

Photograph by Alfred M. Bailey

AN INQUISITIVE BIRD

The Louisiana herons standing on their nests with necks silhouetted against the sky resemble a row of question marks. They allow a photographer to approach within a few feet of their homes before launching awkwardly into the air

one of many—among the gleaming keys.

There are many places along the Louisiana coast of interest to the bird lover, and I know of no spot more delightful than "Willow Pond" on Avery Island. This sanctuary has been described elsewhere, so I will not attempt to tell of the wealth of bird life that congregates on that little place of refuge. It is enough to say that thousands of snowy egrets, Louisiana and little blue herons, least bitterns, gallinules, and anhingas nest there in security.

In the dense cypress swamps surrounding the "island," which, by the way, is merely a high bit of ground rising several hundred feet above the surrounding marshland, are many species of southern birds. The great horned owl is common, and the bald eagle is occasionally seen sailing majestically over the open marshes. He nests in the tallest of cypress trees, the great bulky nest towering against the sky line.

To the westward, in Cameron Parish, is the picturesque Black Bayou meandering toward the gulf, its banks grown with majestic cypress. Along this bayou and the adjacent marshland, are to be found the last roseate spoonbills in Louisiana; wood ibis sail overhead on almost motionless wing, and white-faced glossy ibis and fulvous tree ducks are seen in flocks.

"Bird Island," a bit of woodland in the marsh, has been set aside by the owner, Mr. William Lea, as a refuge for nesting birds, and the last of the roseates in Louisiana dwell there in company with American egrets, black and yellow-crowned night herons, the Louisiana, little blue and little green herons.

Farther down Black Bayou is an enormous tract owned by Mr. Lutcher Stark that is one of the greatest wintering grounds of wild fowl in America, and if one were to attempt to list the birds occurring there, it would be necessary to name most of the wild fowl of the Mississippi Valley. Chenier au Tigre,—the name brings back pleasant memories of high knolls along the gulf, with wonderful moss-hung live oaks and thick-growing palmettos, of wind-whipped ridges, hardy hackberry, ironwood, and acacias, and fields of prickly pear. There are wide stretching sand beaches, vast salt marshes, wooded areas, and comparatively high prairies. Chenier au Tigre is typical of many places I have visited along the Louisiana coast, the climate is delightful, birds are abundant at all seasons of the year, and the kindly people who dwell there always make the visitor welcome.

An Actual Stage Scene in a Japanese *No* Theater

MASKS AND DRAMAS OF OLD JAPAN

The Myths and Legends of the Ancient Orient Live Today in the *No* Play of Japan—Its Traditions, Masks, and Costumes

By S. ICHIKAWA
Department of Anthropology, American Museum

THE MASKS ILLUSTRATED ARE FROM THE AMERICAN MUSEUM COLLECTIONS

ALL great peoples have developed some form of the drama and the stage. With these are associated the great traditional literatures of the world. For the most part, drama precedes the art of writing and written literature, thus taking form in the age of myth and magic, and so it comes about that when the art of writing develops and these old dramas are set down on paper, they are rich in mythical and magical elements.

Japan, like the other great civilized nations, cherishes her ancient literature and her traditional dramas. Among the most famous are the so-called *No* plays. These are highly individualistic types of drama and are still popular in Japan. The *No* plays require a special kind of stage and costume, for the characters in these plays are prominent in Japanese folklore, and the details of their costumes are fixed by tradition, so much so, that if the actor is correctly garbed, the audience knows what character he represents. The facial features of these characters are also fixed by tradition and, in consequence, the actor wears an appropriate mask. Since the face is the truly expressive part of man and the key to his emotions, special attention is given to these masks; indeed they hold a prominent place in Japanese art.

Recently, the American Museum acquired and placed on exhibition in the Japanese Hall a collection of these Japanese dramatic masks, the gift of Dr. W. L. Hildburgh. Such masks are carved from kiri wood (*Paulownis imperialis*), or hinoki wood (*Chamæcyparis obtusa*), and then painted. The masks used in *No* dramas number about 120, and are usually classified in five types: old person, male, female, god or goddess, devil or goblin. Many masks still in use are of great antiquity, ranking as important specimens of ancient Japanese sculpture. It is said that some masterpieces are carved in such a way that they change expression when held

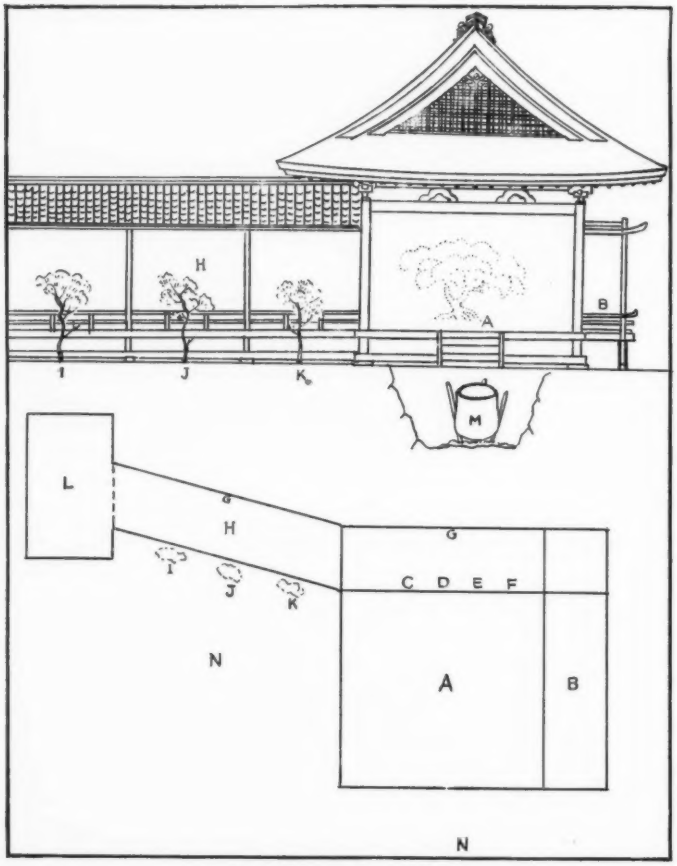


DIAGRAM OF *NO* STAGE

A. stage; B. chorus; C. stick drum; D. large hand drum; E. small hand drum; F. flute; G. back wall; H. gallery; I. J. K. real pine trees; L. greenroom; M. porcelain tub; N. audience

at different angles, so that when looking upward they appear cheerful, and when looking downward, melancholy. In all cases the expression on the mask must suit the character represented in the play.

There is an old story that a certain mask carver carried off a lovely maiden to a forest and, tying her to a tree, pricked her body with a knife to produce in her face the expression of mingled emotions of anger, pain, and despair, so that he might model a mask vividly portraying these emotions. He did succeed in creating a masterpiece, but only at the price of his life, because he was put to death, in accordance with Japanese law.

As in the case of many other ancient customs, the origin of the *No* plays is believed to have been supernatural, and is accounted for in a myth. This tale, as told in the *Nihongi*, a book written in 720 A. D., recounts how once, in godland, the god Susa-no-o-no Mikoto insisted on tormenting his sister, Ama-terasu Oho-mi-kami, the Sun-goddess and ancestor of the Japanese roya family. He let loose the heavenly piebald colts in her rice fields; he insulted her. All this she bore. But last of all, when he saw Ama-terasu Oho-mi-kami in her sacred weaving hall engaged in weaving the garments of the gods, he flayed a piebald colt of Heaven and, breaking a hole through the roof of the hall, he flung the skin in. Ama-terasu Oho-mi-kami started up in alarm, and wounded herself with the shuttle. This last indignity was too much to bear. She straightway entered the Rock-cave of Heaven, fastened the Rock-door, and dwelt in stubborn and haughty seclusion. Thereafter constant darkness prevailed on all sides, and the alternation of night and day was unknown.

Then the eighty myriads of gods met on the bank of the Tranquil River of Heaven (Ama-no-yasu-kawa) and considered in what manner they should supplicate her. One god gathered "long-singing birds of the Eternal Land" (cocks) and made them utter their prolonged cry to one another. Moreover, he made Ta-jikara-o-no Mikoto, the God of the

Strong Hand, stand beside the door, so that in case it were opened for even a crack, he might force it open all the way. Other gods dug up a five-hundred branched sacred tree of the heavenly Mount Kagu. On it they hung strings of jewels and a great mirror, and on its lower branches they hung sacred offerings. Then they recited their liturgy together. Last of all, the goddess Ama-no Uzume-no Mikoto took in her hand a spear wreathed with Eulalia grass, and standing on an inverted tub before the door of the Rock-cave of Heaven, gave forth a divinely inspired utterance and performed a stately mimic dance, while the tub echoed sonorously under the tap of her dancing feet.

Ama-terasu Oho-mikami heard this, and said: "Since I have shut myself up in the Rock-cave, there must surely be continual night in the Central Land of Fertile Reed-plains. How then can Ama-no Uzume be so gay?" Piqued by curiosity, the Sun-goddess opened the Rock-door for a narrow space and peeped out. Then Ta-jikara-o-no Mikoto took her by the hand and led her out, and she consented not to return to her cave.

In the modern stage of the *No* theater, arranged according to tradition, a porcelain tub is placed directly under the stage, so that the stamping of the actors' feet in the dance will echo with greater resonance. This stamping of the shoeless foot is an important feature in the dancing; and considering also the fact that the sun plays a significant rôle in the primitive drama, some authorities accept these as light on the origin of the *No* drama.

The *No* stage is about eighteen feet square and of wooden construction throughout. The back wall is of bare boards decorated only with a painting of a pine tree executed directly on the wood. The front and two sides of the stage are open, no curtain being used. To the left of the stage runs a narrow, covered gallery leading to the greenroom, the entrance to which is curtained off. Sometimes the

THE MASK-MAKER
A page from an old illustrated Japanese book devoted to the history of *No* masks

THE SPIRIT OF THE MOUNTAIN

From a Modern Japanese Print

The print represents an actor impersonating the Yamauba, or "old woman of the mountain." This spirit is always represented as having long white hair, and carrying a cane with a T-shaped head. A bunch of leaves is fastened to the cane. As in all *No* plays, the actors are men. The mask used in the impersonation is shown at the lower right

KUMASAKA THE FAMOUS BANDIT CHIEF

From a Modern Japanese Print

Kumasaka carries a halberd in his right hand and a short sword on his hip. In the play he is killed by a small boy, in reality a great warrior and fencer. This boy in his disguise mingles with the servants of a rich merchant, who is held up by Kumasaka and his gang of desperate bandits. At the left is the mask used in this impersonation

THE WHISTLER
This particular mask is called "Usofuki" and belongs to a class of masks used in the *Kyogen*, or farces

back wall of this gallery is painted with bamboo trees. The pine tree back of the stage is traditional, as are three small real pine trees planted in front of and close to the gallery. There are no "settings" whatsoever on the *No* stage. The properties are few and of highly conventionalized type and weapons alone are realistically represented.

The *No* relies enormously for its effects on gorgeous and elaborate costume. In olden times, *No* plays were given by the nobility only for members of their own class, and feudal lords, when entertaining each other, prided themselves on their *No* stages, and especially on the costumes, vying with each other to produce a dazzling impression. Incidentally, this fact stimulated the development of the art of textile weaving in Japan.

Since there is no curtain in front of the stage, the entrance of chorus and musicians in stiff and stately movement marks the opening of the play. Their retreat from the stage in the same formal manner marks the end. There are in these plays only two leading characters; they are called "Shite" (doer) and "Waki" (assistant—always a male rôle). Each of these main actors has companions called "Tsure"; some plays, however, need no actors but the two main ones; others use as many as ten or fifteen performers. The female rôles are taken by men. The movement of an actor's body is prescribed and regulated by severest rules. Every step, every movement, in the dance—even to those of the toes and fingers—is strictly governed by tradition.

The chorus is seated to the right of the stage, the musicians upstage. The music which accompanies the action consists only of a stick drum, two kinds of hand drum, and a flute.

THE JOLLY WOMAN
Another *Kyogen* mask called "Okame" or "Ofuku," a fun-making character known to all Japanese play-goers

The *No* dramas are based upon short, lyrical tales, taken for the most part from the folklore of Japan, China, and some adjacent countries. The texts are written in exceedingly ornate language and contain as quotations many ancient songs and sayings. The ethical principles exemplified in the plays are those of Shintoism, Buddhism, and Confucianism. The plays resemble the classic Greek drama in being performed out of doors, and are highly formalized in that the speeches are entirely chanted, movements are stylized, many of the characters wear masks, and the chorus takes up the action where the dialogue leaves off.

In regard to this traditional formalism, Mr. Arthur Waley says in his book, *The No Plays of Japan*, that

> The theatre of the West is the last stronghold of realism. No one treats painting or music as mere transcripts of life. But even pioneers of stage reform in France and Germany appear to regard the theatre as belonging to life and not to art. The play is an organized piece of human experience which the audience must as far as possible be allowed to share with the actors. A few people in America and Europe want to go in the opposite direction. They would like to see a theatre that aimed bodily at stylization and simplification, discarding entirely the pretentious lumber of nineteenth century stageland. Such a theatre exists and has long existed in Japan.

"SHIKAMI"—A MALE DEMON
The name of this *No* mask, representing a male demon called "Shikami," means "a cross-looking face"

"HANNYA," THE CLASSIC FEMALE DEMON
One of the most popular characters in the *No* plays is represented by this mask

Today only 210 of these early *No* plays are extant, but it is believed that a considerably larger number of them existed in olden times. There are still in Japan five different schools in *No* performance, each school having a history and tradition peculiar to itself. These schools are: Kwanze, Hōshō, Komparu, Kongo, Kita. The story of the Sun-goddess and the dance before the Rock-cave gives a legendary explanation for the *No* drama. It is interesting to note that this dancing is supposed to have taken place before the

KWAGETSU—A WANDERER
From a Modern Japanese Print

A young ascetic and wanderer is the chief character in a *No* play "Kwagetsu." When only seven years old, so the story runs, he was stolen by a goblin. His father became a Buddhist priest and by accident found his wandering son at the temple of Kiyomizu at Kyoto. In the play the wanderer thinks he has no enemies, so he carries only a small bow and a single arrow for driving away birds that he finds spoiling the beauty of the flowers

THE MYSTIC SERPENT IN HUMAN FORM

From a Modern Japanese Print

In the play called "Dojyoji," a beautiful maiden loves a Buddhist monk who is not permitted to marry. The monk flees from her and hides in the temple. The maiden pursues him but is stopped by a river flood. She is transformed into a large serpent and swims the river. The monk hides under the great bronze temple bell, but the serpent crushes the bell by the power of her coils, and kills him and herself

Japanese (Yamato) race migrated to the Islands of Japan, and if we take into consideration also the factors of cave, river bed, and Sun-goddess (female rule of the tribe occurs chiefly in the southern part of Asia and Oceania), we may reconstruct an imaginary picture of a tribal dance of the ancestors of the Japanese living somewhere in southern Asia under the sway of a female ruler.

THE DANCE OF AMA-NO-UZUME
This old Japanese print shows the dance in front of the cave to which the Sun-goddess retreated when insulted

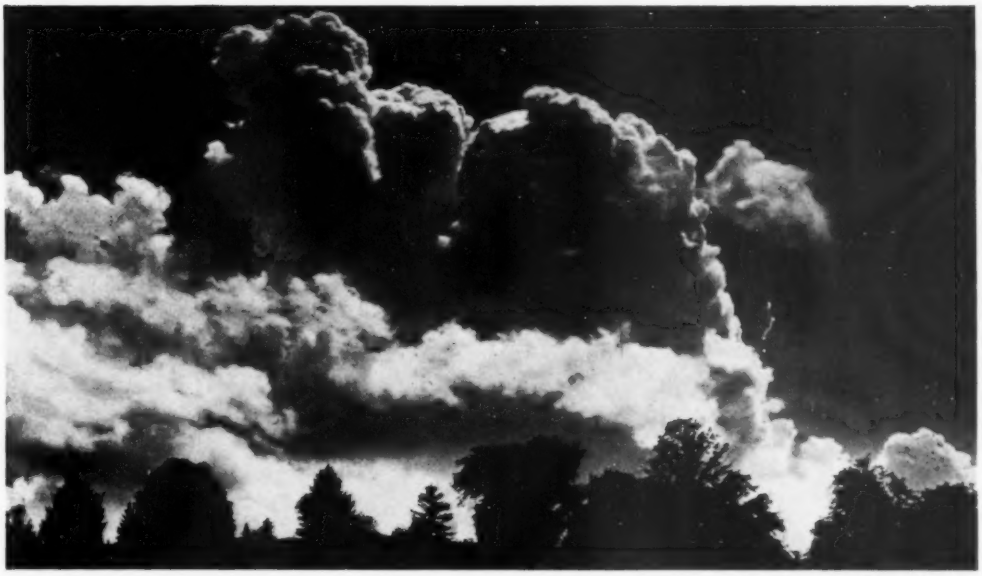
It is generally accepted, however, that the *No* play is a gradually integrated development of Sarugaku (Shinto ceremonies). Dengaku (at first an acrobatic and juggling exhibition and later a sort of opera), Gagaku (the Chinese dance practised at the Japanese court), and various sorts of recitation and ballad singing,—a composite, in other words, of the sacred with the secular, of ceremony to honor the gods and entertainment for human beings. The religious *No* dance led to the secular *No* play. In the Muromachi period 1392-1603), the *No* play underwent popularization, becoming an adjunct of congratulatory or commemorative occasions, and also pure diversion. This period produced many *No* dramatists and *No* was considered an essential part of every aristocratic entertainment, while the Shinto shrine continued to be the principal scene of its performance.

The *No* is stately and solemn, but "Kyogen," farces are given as interludes between the scenes or as part of the *No* play. Some of these Kyogen also date from the Muromachi period, and may have had a development parallel to that of the *No*. The masks used in this type of play are of course for the most part comic in appearance, as shown on page 246. At present there are three schools of Kyogen,—Sagi, Okura, Izumi.

The *No* play was really the source of the Joruri (epical drama) and the Kyakuhon (which is nearly the same as the European drama), both of which were developed during the Tokuzgawa period, 1603–1867.

Such, then, is a brief outline of the history of the peculiar ancient drama of Japan, a most interesting field for the student of drama and the dance.

A PAGE FROM THE PLAY "HAGOROMO"



Photograph by W. A. Bentley

The rounded summits of this cumulus cloud show distinct thunder heads

WEATHER PROPHETS OF THE SKY

Significance of Cloud Formations in Foretelling Weather Conditions. The Importance of a Knowledge of Air Currents in the Layers of the Atmosphere

By HERBERT P. WHITLOCK
Curator of Minerals and Gems, American Museum

Then follow you, wherever hie
The travelling mountains of the sky.
—"*Song of the Road*," Stevenson

CLOUDS always have had and always will have a special appeal to people who love the out-of-doors; they are distinctly part of the facts, fancies, and phenomena that we group loosely under the term "natural history." But to what realm of nature do clouds owe allegiance? The answer is that they are forms of mineral—for water is a mineral in spite of its usual state of fluidity.

When we contemplate a cloud-flecked summer sky, perhaps from a hilltop, or from the open fairway of a golf course, our imagination may need to stretch to a considerable degree to bring home to us the truth that these shreds of water vapor and masses of snow particles are floating suspended in a sea of air at the bottom of which we crawl or scurry according to our mood. Since we have begun the mastery of the air,—the only portion of our environment not yet wholly conquered,—clouds have assumed for us a very vital interest, because they clearly indicate the currents and conditions existent in the various layers of the atmosphere.

Above the highest range of an aëroplane move the delicate, wispy plumes of cirrus clouds that often presage the movements of air currents in the lower depths of our atmospheric ocean, and as we come to consider the clouds of lower elevation above the earth, their significance as foretellers of weather conditions becomes more obvious and imminent.

Sailors, fishermen, and in fact all men

Photograph by W. A. Bentley

FRACTO-CUMULUS CLOUDS

The characteristic flat lower side of this group of broken-up cumulus clouds of the alto level is well brought out in this photograph

Photograph by W. A. Bentley

HIGH FOG

This is still a cloud even though it has come to earth. Such a fog climbing up a hillside gives promise of sunshine before long

Photograph by W. A. Bentley

CIRRO-CUMULUS FORMATION

This is a typical mackerel sky. The small white clouds flecking it are familiar to everyone as prophets of rain in the near future

Photograph by W. A. Bentley

ALTO-CUMULUS WAVES

Aviators know that a wavy, cloud-streaked sky such as is shown above betokens treacherous air conditions, because the ribbons of cloud mean bands of unequal air pressure

Photograph by W. A. Bentley

CUMULO-NIMBUS CLOUDS

Ascending air currents have caused this cumulus cloud to build itself up to a vast altitude. The summit is probably five miles above the earth

whose lives are spent on or near the sea, are well versed in the meaning of cloud forms, but something of what they have learned at the price of long and often hard experience may be added to our natural history knowledge by the easier and shorter route of study and intelligent observation. *Cloud Studies*, by Arthur W. Claydon, published by John Murray, London, is one of the best books I know of for information on this subject.

To equip ourselves for "intelligent observation" requires a very simple appliance; all that is necessary is a black mirror made of a small sheet of glass painted on one side with a black varnish or lacquer. In this simple contrivance one may reflect the brightest sky without undue eye strain and, once accustomed to seeing the sky as if it were in an inky pool, one will find even the thinnest and most evanescent thread of cirrus reflected with startling clearness and detail.

Of course to make a record of an unusual cloud form, a camera equipped with a simple color screen is necessary, and since all but the darkest and most lowering skies register very rapidly on the photographic plate, the slowing effect of the color screen is neutralized. A little experience enables one to time exposures correctly and to achieve good results.

The camera has also been used to good effect in determining the height of clouds. For this two cameras are employed, set at the ends of a measured line and arranged to give simultaneous exposures. With the lenses covered by color screens and well stopped down, the cameras are directed at the sun's disc, the image of which is bisected by cross wires placed back of the lens combinations. As a cloud approaches the position of the sun, the two exposures are made at the same instant, with the result that the position of the cloud with respect to the sun is not quite

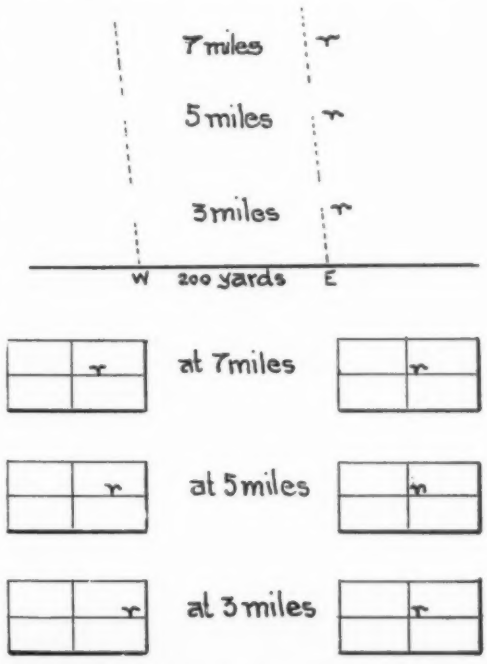
the same in both negatives, and the closer the cloud is to the cameras the greater will be the difference. The paired negatives are carefully measured with respect to this difference, and a mathematical formula, of course involving the distance between the cameras, is applied, which gives the height of the cloud. A glance at the diagram on this page in which the cloud is represented by a flying bird may help to make this plainer.

Owing to the temperature of the air, clouds of a certain type are higher in summer than in winter.

In naming the various types of clouds, in general, three descriptive words are used:

(a) CIRRUS (combining form, *cirro-*) includes cloud forms resembling delicate threads, feathers, or strands of wool.

(b) STRATUS (combining form, *strato-*) is applied to clouds that extend in more or less level sheets.



DETERMINING THE HEIGHT OF A CLOUD BY THE USE OF TWO CAMERAS AS EXPLAINED IN THE TEXT

Photograph by W. A. Bentley

CUMULUS CLOUDS

An approaching thunderstorm is indicated here in the billowing masses of towering clouds. These forms are often seen on hot August days

Photograph by H. P. Whitlock

LONG, NARROW SHEETS OF CIRRO-STRATUS CLOUDS IN FORMATION

Photograph by H. P. Whitlock

BEGINNING FORMATION OF ALTO-WAVE CLOUDS

Photograph by H. P. Whitlock

CIRRO-STRATUS CLOUDS CLEARLY DEFINED

Photograph by H. P. Whitlock

ALTO WAVE STRUCTURE PARTIALLY FORMED

Photograph by W. A. Bentley

CIRRO-STRATUS CLOUDS BEHIND DENSER ALTO-CUMULUS

Photograph by H. P. Whitlock

CRESTED ALTO WAVES FULLY DEVELOPED, A SURE STORM SIGNAL

Photograph by W. A. Bentley

THIN, HIGH CIRRUS CLOUDS OF WIND-BLOWN SNOW

Photograph by H. P. Whitlock

TAILED CIRRUS—EACH THREAD A MINIATURE SNOWSTORM

Photograph by W. A. Bentley

THREAD CIRRUS—A HARBINGER OF GOOD WEATHER

Photograph by H. P. Whitlock

CHANGE CIRRUS—CONSTANTLY DISAPPEARING AND REFORMING

Photograph by H. P. Whitlock

HIGH CIRRUS—THIN WISPS OF SNOW CLOUDS

Photograph by H. P. Whitlock

BAND CIRRUS—ALWAYS FOLLOWED BY STORMY WEATHER

Photograph by W. A. Bentley

CUMULO-NIMBUS CLOUDS

The shadow cast by these dense thunder clouds as they come over the hills gives warning of the rain that will follow in their wake

(c) CUMULUS (combining form, *cumulo*=) denotes the rounded, lumpy shapes of cloud.

Then we have the division of clouds according to their relative heights above the earth, as, the upper clouds, the intermediate clouds, and the lower clouds, as well as those towering cloud masses that extend from the lower up into the intermediate regions of the air.

In general the highest clouds are of the cirrus and cirro-stratus types, which means that they occur as high as seventeen miles in summer, and fifteen in winter. The intermediate division ranging from fourteen to eight miles in summer, and twelve to six in winter, includes the types that are named cirro-cumulus, alto-stratus, and alto-cumulus. Nearer the earth form the strato-cumulus, cumulus, and nimbus, or storm clouds, ranging from five to two or three miles in the air. Cumulus clouds are often three miles in depth, covering the whole range of the middle lower atmosphere in height, and the mountainous cumulo-nimbus, which herald a thunder storm on a hot summer day, tower some eight miles from the ground. Still nearer to the ground are the stratus, which merge into the high fogs that we often see on summer mornings suspended in air halfway up a hillside.

Since the rarified upper air, which is the region of clouds of the cirrus type, is below freezing point in temperature even in summer, it follows that cirrus clouds are formed of ice particles or minute snowflakes. In one of the illustrations, showing tailed cirrus (page 257), we can actually see a series of small snowfalls, each descending from its own cirrus cloud until melted and dissipated in the warmer layers of the atmosphere below.

Indeed, continual forming and melting away is a conspicuous characteristic of all

cirrus clouds. A good instance of this tendency is illustrated in the photograph of change cirrus (page 257) which shows a stratum of the air that has just become saturated with moisture to the point of forming a cloud.

Windy cirrus shows the effect of rapidly moving air currents in the upper air and foretells strong winds at the earth level.

Band cirrus, the broad radiating fans of cirrus cloud, is a sure omen of ill weather, falling barometer, and general storm conditions. The usual forms of cirrus cloud, particularly those with threadlike and feathery outlines, mean fair weather for at least a day after they are seen, and probably for several days to come.

It is not possible to draw a sharp dividing line between the high clouds of the cirrus types and those of the intermediate layer which are often called the alto clouds. In general we may assume that the alto clouds are composed of liquid instead of solid particles, and consequently they appear somewhat denser, in the same way that a fog at the ground level seems denser than the air filled with a light fall of snow. In this category belong alto-cumulus clouds of several variations, including the familiar mackerel sky, and the less common, high, ball-cumulus, both of which foretell a rainy change in the weather. Alto-cumulus clouds will always merit close watching, as they often precede the formation of the huge, lofty, thunder clouds whose menace is unmistakable.

Clouds of the cumulus type, particularly those of the intermediate layers of the atmosphere, constitute the most picturesque and obvious of the cloud forms. As alto-cumulus and cumulo-nimbus they furnish us with the piled-up rounded masses of water vapor so dear to the hearts of painters and etchers. Each large cumulus cloud may be regarded as the visible top of an ascending pillar of moist air, the upper part of which is condensed by contact with the cold of the stratum of air at which it becomes visible. These are the clouds that cast shadows over the landscape of field and hillside,

Photograph by W. A. Bentley

ANOTHER FORMATION OF CUMULO-NIMBUS
The torn, dark masses bear all the indications of a rapidly approaching thunder storm

and the fact that they cut off, in a measure, the sun's rays, does more than create a pleasing picture. This shadowed part of the ground is cooler than where the summer sun has unobstructed power to heat the surface stratum of air, so that by means of the unequal temperature, a rising current of air is set up, carrying moisture with it to augment and heighten the cumulus cloud which is its top. Such a cumulus is generally formed during the afternoon of a warm day when there has been little wind, and the almost inevitable result is a thunderstorm. It follows, from the mechanics of this cloud type, that its base is nearly flat, and it takes the shape of an irregular cone.

The atmosphere, a knowledge of which is of great service to aviators, generally consists of layers of unequal pressure. Many disasters to aëroplanes have been caused by their unexpected entrance into one of the low-pressure areas. Now, when a series of high and low-pressure zones of the atmosphere encounter air almost saturated with moisture, there will be condensation in the high-pressure areas and evaporation in the low-pressure ones. The result is a series of wavelike movements of cloud caused by alternate forming and dissolution of cloud masses. Such waves of clouds, traveling much as do the waves on water, occur at all altitudes. Seen during a period of fine weather, they invariably mean a change, with either wind or rain or both.

Alto waves are fascinating cloud types to watch, particularly if one is fortunate enough to see the preliminary steps in their development as well as the phenomenon at its height. In three of the series of cloud photographs used in this article, a succession of stages in the formation of alto wave clouds is shown, the plates having been exposed a few minutes apart (See page 256).

Several delightful books have been written on clouds, but the best way to learn about them is to sally forth into the country-side with stout heart and shoes, and see the clouds in their true environment, which, to my thinking, is not where one's vision is interfered with by a skyscraper or a church steeple, but where the sky line is fringed with trees and haystacks above which one may study to his heart's content these weather prophets of the sky.

Photograph by W. A. Bentley

"TRAILING CLOUDS OF GLORY"

A sunset sky, even without the color, is a thing of supreme beauty

Native road workers in the Sudan doing their part in modernizing Africa

BY MOTOR FROM NAIROBI TO THE NILE

An Automobile Tour Across Eleven Hundred Miles of Central Africa—Roads and Hotels, Rest Camps and Bridges, Factories and Golf Courses—How Central Africa Is Changing, and the Effect of the Change upon the Animal Life

By JAMES L. CLARK
Assistant Director, In Charge of Preparation, American Museum

STANLEY'S "Darkest Africa" has long since given way to Carl Akeley's "Brightest Africa," but even yet there are a great many misconceptions abroad regarding that continent.

That the great herds of game are giving way before the advance of civilization is a widely accepted fact, but the extent to which civilization is penetrating the districts where the gigantic herds formerly ranged unchallenged is not widely understood. There is a great deal of criticism of the sportsmen who take their safaris into that land and bring home "trophies" with which to decorate their walls and floors, but that the settlers are killing far more game than are the sportsmen, and are driving the remnants of the herds from their natural grazing grounds into more remote regions, is not so often called to the attention of the world.

It has been my privilege to visit East Africa three times. In 1909, when I first entered that animal Eden, the plains were literally swarming with herds of wildebeest and zebra, gazelle, impalla, eland, and scores of other animals. Rhinos and lions were numerous. Elephants were to be found in tremendous herds Everywhere one went there were animals and signs of animals. Settlers were few. The natives had long since adapted themselves to life in a land teeming with game. There was little interference with the animals and as yet civilization had made little impression upon the creatures of the wild.

The railroad had been built from Mombasa to Nairobi, it is true, and a little way beyond, but aside from that route of travel there were few in the whole land. Roads led a little way from Nairobi in

A ROADWAY IN THE NEW AFRICA

On this broad avenue, bordered by acacia trees, Mr. Clark drove into Naivasha. Just beyond this spot a few kongoni and Thompson's gazelles were seen—practically the only game in evidence during 1100 miles of travel

various directions, but they did not go far, and only the native trails led farther across the plains and through the jungles. Thus the range was not cut up. The natural migratory movements of the animals were not interfered with, and the regime that Nature had built up during thousands of years was still in force.

In those days, the person who wished to see British East Africa did so with a slowly moving safari that made ten or fifteen miles a day—sometimes more, but rarely. The automobile had not entered the wilds. Automobile roads were unheard of, and the game was not tremendously impressed by the activities of sportsmen or professional hunters.

But all that is changed. Where, in 1909, not an automobile road existed in all of British East Africa, now there is a network of such roads over which one may drive at much the same breakneck speed that is common on the roads of the United States. Bridges cross innumerable streams. Highways stretch in every direction across the plains, and the range is consequently broken up into small districts entirely surrounded by routes intended for the mechanical horse.

Now it is obvious that all of this is having its effect upon the game. There are all sorts of laws protecting the animals, of course, as there should be, but law cannot stop the advance of the settlers. As a matter of fact, the law aids them. And how can the settlers erect their fences and plant their fields if herds of elephants are permitted to wander about the place, stamping whole fields of corn into the ground, tearing down structures, and otherwise interfering with the developments and the labor upon which the settler's success depends?

In the United States the bison gave way

before the same inexorable advance of civilization, and for identically the same reason. It was impossible for the farmer on the Nebraska plains to make a success of what was, at best, a difficult job, if, in addition to the other difficulties that had to be overcome, herds of bison were permitted to stamp his wheat into the earth and otherwise interfere with the labors upon which the citizens of that new land were forced to depend. We have bewailed the passing of the buffalo, of course, and have managed to save a few—because they are hardy beasts—with which to decorate our parks and zoos. But if we could have the old herds back for the asking, would we accept them? Naturally not. They could not be made to fit into the present scheme of things.

That is identically the situation that is facing British East Africa today. The game, of course, in that land of animals is comparable to what it was in our middle west, but already there has been a tremendous decrease in those numbers, and not a year passes but what the herds are smaller than they were before. Not a year passes but what British East Africa comes closer to the situation, in regard to game, that Nebraska and Kansas are in today. Nor are the sportsmen principally to blame. They kill many animals, it is true, but advancing civilization is the greatest killer of them all. Even if there were no sportsmen, the final outcome would be the same, although, of course, the finale would not come so soon.

Last year, after the field work of the Carlisle-Clark Expedition had been completed, I decided to go from Nairobi to the headwaters of the Nile, rather than to sail from Mombasa. It was my desire to see that portion of Africa between Lake Victoria Nyanza and the head of river

CROSSING THE DIVIDE

As one nears Uganda, the roadway stretches through dense forests of cedars and bamboos. This part of the country being mountainous, good roads are doubly appreciated. The above picture was taken at an elevation of 8500 feet, after leaving Molo

A MAIN THOROUGHFARE

Typical of the roads passing through banana tree groves is this one in Uganda. A subsurface of hard, volcanic rock, called ironstone, lying from one foot to eighteen inches underground, makes the construction of good roadbeds easily possible in Uganda

navigation at Rejaf in order that I might more properly attack certain problems in the Museum having to do with specimens that come from that region. And I naturally chose the easiest method of transporting my wife and myself across that eleven hundred miles of what, only a few years ago, was comparatively unknown country. Many people living today recall when Speke, in 1858, discovered the source of the Nile, and the route I chose was to lead us past Ripon Falls where the mighty river of northern Africa has its beginning in the waters of Lake Victoria Nyanza.

It will be seen, therefore, that we were to go through a land upon which civilization has had only a few years to work—in which the game formerly was to be found in enormous numbers—to which sportsmen have never gone in very great numbers. Furthermore, twenty years ago, a crossing of this very land would have called for a very well equipped expedition, and would have demanded the utmost care in plans and leadership.

As it was, Mrs. Clark and I packed what belongings we needed in the tonneau of a touring car, hired a native "boy" to serve as general factotum, and left Nairobi at noon on October 18, 1928, intent on reaching Molo, 134 miles distant, that evening. That alone shows how shrunken are the game fields of Africa. A "march" of 134 miles twenty years ago would have consumed a week at least, and that would have been very rapid indeed. Furthermore, from fifty to one hundred porters would have been hired in order to carry the equipment for the outfit. The leader would have looked over his guns and ammunition with the utmost care, and more than one adventure with animals would probably have befallen some one in the party during the course of that week.

With us it was very different. At the last minute, as I entered the car, Mrs. Clark asked where our guns were, and I smiled as I admitted that I had forgotten to include them. We were not intending to hunt anything, of course, and guns, consequently, would have been used, if at

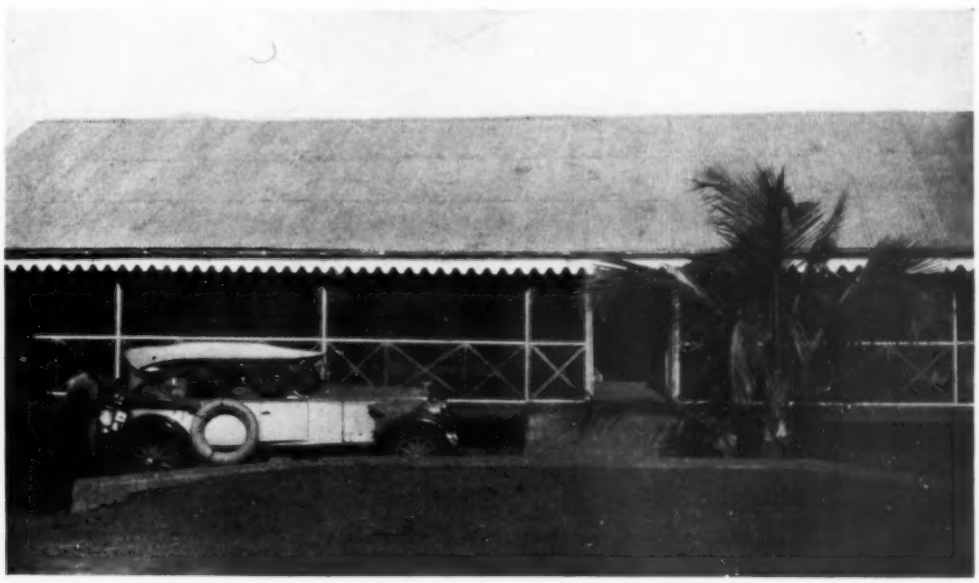
all, merely to protect ourselves. But so changed is Africa that I decided we did not need even that protection, so I stepped on the starter and we began our journey without spending the fifteen minutes it would have taken me to get the guns and ammunition that would have been absolutely essential a few years ago.

Nor was this mere bravado. The truth is that we had no need for them. Eleven hundred miles of automobile roads lay ahead of us. Several towns of fair size were on the way. We did not even have a tent, for we would stay at hotels and rest camps each night, unless, of course, something unfortunate befell us, and then we would spend the night in the car.

It took us less than seven hours to reach Molo, after averaging twenty miles an hour. We could have done it in less time, but as Mrs. Clark preferred not to ride too rapidly, we took our time. To the hunter in Africa a few years ago it would seem downright inane to say that we "took our time" and still covered 134 miles in an afternoon.

Imagine yourself on a motor tour through a magnificently beautiful country with good roads and almost no one to use them but yourself. There was no one ahead of us—no one behind. There was no dust, few bumps, and the day was fine. Through the foothills of the Aberdares wound the road, past native garden patches, open fields, and stretches of dark, primeval forests where once roamed the buffalo and elephant. Now this is the Kikuyu Reserve where those natives grow their patches of maize. The huts and "shambas" of these natives are neat and well kept, for the Kikuyus are industrious, which cannot be said of all the native tribes of Africa.

Leaving this undulating country, we wound our way along hillsides and down valleys to Lumoro, where we dropped down the escarpment into the Kidong Valley. There lay Lake Naivasha surrounded by weird and rugged mountains, with a crescent-shaped island—a part of the rim of an extinct volcano—showing clearly above the smooth blue water.

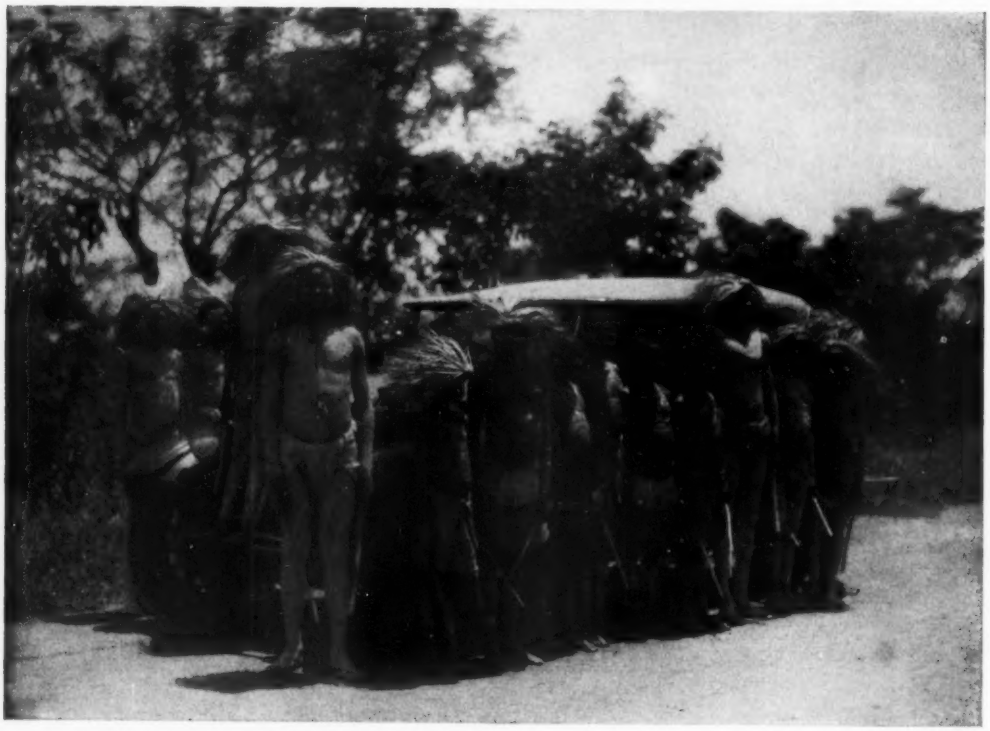


THE RAILWAY HOTEL AT KISUMU

In this thriving little town a comfortable rest house in conjunction with the station accommodates both automobile and train tourists. Kisumu also boasts garages, and a number of small shops

ON THE WAY TO RIPON FALLS

What many readers still imagine to be the "wilds" of Africa often prove to be similar to portions of Long Island. Here a modern golf course completes the illusion, heavy traffic and billboards alone being lacking



FOR THE BENEFIT OF TOURISTS

In ceremonial attire of grass headdress and white clay smeared on their bodies, these Uganda natives wait by the roadside for passing wayfarers. They then dance and pose for their pictures in return for small change

A PRACTICAL USE FOR THE NILE

The British government has recently completed this new power plant, which takes advantage of the power of Ripon Falls to supply lighting for the town of Jinja. Native workers are employed under white supervision

THE HEADWATERS OF THE NILE

The Ripon Falls, sliding smoothly from the level of Lake Victoria Nyanza and dropping about twenty feet to start the White Nile, resembles a stream of cold, liquid glass. Bird life is particularly abundant about here

AN AFRICAN TREASURY AT KAMPALA

These ivory tusks, laid out for inspection by the government treasurer, are part of a collection worth $100,000. Some have been paid in as taxes, others have been found, and many have been confiscated because they were secured illegally by hunters

We drove along avenues of acacia trees into the town of Naivasha, and ascended the rise to the northwest on the road to Gilgil. As we rolled away with Naivasha behind, we saw a few kongoni and Thompson's gazelles,—a dozen or so—and later, as we sped over better roads than we had had, we spied four or five impalla.

We had dropped into the Kidong Valley when thirty-one miles from Nairobi, and we followed the floor of the great rift which is divided into a series of basins holding lakes of varying sizes. Black rain clouds hung about in the sky and showered us twice, but always there were bits of blue sky visible, and the landscape still stayed bright.

From Nakuru north we could see great sweeping valleys, now taken up entirely by ranches. There were enormous areas given over to corn and wheat filling the valleys for miles, broken here and there by patches of deep green trees. All this scene was enclosed by distant rugged hills that were tinted with late afternoon hues that radiated from the setting sun.

Leaving this, our sienna-red road undulated still upward into grass lands interspersed with great forests. As we entered these we became lost in big cedars forming a jungle rain forest, but on through the dense growth our smooth road ran, until, finally, we reached the little town of Molo which lay surrounded by the vividly colored open glades filled with Kikuyu corn. Behind the corn lay the heavy forest beneath a black rain cloud upon which glowed the setting sun.

We stopped for the night at "The Cross Roads Inn."

For nine days we drove through this land of beauty. We passed through luxuriant forests and bamboo thickets.

We rolled past parklike open spaces that were dotted with table-topped acacia trees, through the wide-spreading branches of which we saw wonderful vistas bathed in sunlight. We took the wrong road in one place and went sixty miles out of our way, but we did not mind, for the road was good and the views were delightful. Here and there, during those nine days, we did find sections of the road that were bad—sections that showed only as discolored lines stretching across the grassy plains, and in one place a makeshift bridge across a stream barely supported the weight of the car. For the most part, however, the roads were fine, and throughout the trip our enjoyment of Africa was tremendous.

In the country of th Kavarondo the roads were often lined with natives, but they were dressed in dirty white "Americano," which completely took the romance from what otherwise was a charming picture.

Beyond Kisumu we skirted the shore of Lake Victoria Nyanza, and passed through a country very similar indeed to Connecticut. Had there been more roadside signs and more houses along the route, the comparison would be more exact. As it is, this portion of Africa has all the attractions of the Long Island Sound coast, without the unattractive elements that have been added.

We crossed an arm of the lake on a ferry, and near its terminus we spied a charming golf course which borders the waters of the lake and swings around to Ripon Falls, the headwaters of the Nile. A new power plant, too, stands near by, taking advantage of the power that for ages has been sliding smoothly over the falls to create the river that is the chief artery of Egypt.

A PRECARIOUS CROSSING AT JINJA

When the capacity load of five automobiles and as many natives as can hang on has been piled on to this ferry, which is nothing more than a scow equipped with a gasoline engine, a passenger recalls with little pleasure the fact that the waters are crocodile-infested

EVIDENCE OF ADVANCING CIVILIZATION

The Motor Tours Rest Camp at Soroti provides a comfortable overnight stopping place. The main dining hall and community house, shown here, is surrounded by a cluster of smaller thatch-roofed sleeping quarters and a kitchen. Tourists usually bring their own food, but "in season" they can buy it on the premises. The camp accomodates about twenty people

The falls are impressive as one approaches the edge of the stream and sees that tremendous volume of water flowing through this outlet of the lake like cold, liquid glass. A little below, the water breaks into a turmoil of foam, but a V of smooth water penetrates that brilliant display of white, as if fighting to quiet the broken surface below.

Bird life is abundant about the falls. White egrets, snake birds, cormorants, and others are numerous. Almost every rock is the resting place of cormorants, and others swim and dive in the white water below the falls. Fish, too, are numerous, and schools of them weave idly about, their dorsal fins showing almost as if they were small sharks.

Returning over the ferry, we started toward Kampala, fifty-four miles away, and two hours later, without having changed gears, we arrived at that charming little city, where we put up at the Imperial Hotel for the night.

At Kampala, which lies on an arm of Lake Victoria Nyanza, we found a thriving little town—a town with garages, with shiny automobiles offered for sale in clean and attractive show rooms, with shops the equal of many small towns in the United States, selling goods that were not dissimilar. The hotel was good, and we were not unduly tired, despite the fact that we had driven 150 miles through what some people still imagine to be the "wilds" of Africa.

Except for the few head of game just outside Naivasha, we had seen none since leaving Nairobi, but now we saw, when we went to the government offices the next morning, about $100,000 worth of ivory laid out on the ground to be examined by

the inspector. Because of the ivory trade, and the business that civilization has brought in, Kampala is a busy place. It is not as large as Nairobi but is much cleaner. The stores are up-to-date, shops and garages are numerous. There are several small brick factories, one of which is a bottle factory, no less. On a high hill above the town is an old fort, below which is an excellent golf course.

The sultani of the Wagandas rules here, and enjoys considerable prosperity under the British. The natives are exceptional and very independent, although they are said to be past masters at the art of stealing. The automobile roads are in excellent condition, with a native road-maker to every mile. Twenty pounds a year are spent per mile of roads in this district, and they are uniformly excellent.

A couple of days beyond Kampala we stopped for the night in the Motor Tours Rest Camp at Soroti. What more is needed to tell of the advance of civilization into central Africa? Later we stopped again at these camps, which are all alike, and are anything but scarce in this region. They are built with a large grass hut in the center, which is a dining room and community structure, and about this central house, smaller grass huts, fifteen feet or so in diameter, serve as bedrooms and bathrooms. Truly, Central Africa is rapidly becoming devoid of its former difficulties.

The natives, after we had gotten well away from the larger towns, were dressed —if one calls is that—in native fashion, and there was a very definite atmosphere of Africa in the landscape when such natives appeared. But, having traveled five hundred miles or more from Nairobi, we expected this, for I do not mean that

USING EMERGENCY PROVISIONS

Occasions still arise which require that tourists be prepared for unexpected delays. Here Mr. and Mrs. Clark were held up for thirty-six hours by a swollen stream. They are pictured lunching with two other automobilists also delayed by the flood

all Africa is given over to automobile roads and rest camps.

At Torit, in the Sudan, we had to ford a stream, but the water was shallow and we had no trouble. Shortly beyond this spot —not more than a few hours—we found more trouble of the same sort. For fully three-quarters of a mile the road was under water. It was too much for our car, but after waiting a day, two small trucks appeared. We talked of all sorts of methods of crossing that section, and finally decided to leave our own car for our "boy" to take back to Nairobi, if we could get the trucks across. We plugged the carburetors and other openings in the motors, and with a small army of natives managed to tow those trucks through.

It was necessary for us to attempt some such method, for we were trying to catch a boat downstream from Rejaf, which lay not far ahead, and it was important that we get through. Beyond this flooded section the roads were less good, but we had no difficulty, and late that evening reached the banks of the Nile directly across from Rejaf. It was by moonlight we crossed the three hundred yards of the smoothly flowing Nile, and early the next morning, from the deck of the river steamer, we saw Rejaf slide away astern and realized that we had crossed 1100 miles of what was once "darkest" Africa —had crossed it without a gun and without any need for a gun—had crossed it, furthermore,—and this is the most striking fact—without having seen any game aside from those few animals that we had passed near Naivasha. We had seen a herd of about fifty baboons, and had seen an occasional animal here and there elsewhere, but game, as game has always been known heretofore in Central Africa, was entirely missing from the picture.

This does not mean, of course, that there was no game in the country. The land was plentifully watered, and game, consequently, did not find it necessary to congregate at water holes. At another season of the year, hundreds of head of animals would be seen on the same route. But the farms, the ranches, and the towns, the automobile roads, and the other intricate trappings of civilization are rapidly converting all this land into a gameless region. The time is not far distant when to the inhabitants of Nairobi and Naivasha, herds of game will be as rare as they are to the inhabitants of Kansas.

At Rejaf I was told that the tusks of 1500 elephants are shipped through that point each year. Such killing of elephants is rapidly bringing to extinction these ponderous and slow-growing animals. If, in any single district, a thousand elephants lived, it would be impossible to kill more than thirty or forty a year if one wished to keep from reducing the herd. Thus it can be seen that these most appealing creatures are rapidly headed for practical, if not actual, extinction.

In telling this story of the "New Africa," it is not my purpose to present too pessimistic a picture. Many things are being done in that continent in order to protect the animals. But no longer is Africa the Africa of Stanley, or even of Akeley. Sportsmen have been guilty of more than a little killing, and they, quite properly, should be carefully controlled. But civilization—and civilization only—will, before many years, practically eliminate the animal life of the greatest of animal lands. It is the duty of all of us who are interested in the preservation of this animal life, to do what we can to interest others in proper conservation, and that, in the final analysis, will be brought about only by the creation of more animal preserves, where hunting and collecting will be prohibited by law, and where that prohibition will be rigidly and honestly enforced.

Guahibo Indians in front of one of their grass huts

CHILDREN OF THE ORINOCO PLAINS

The Guahibos, a Little Known, Primitive Tribe of South American Indians, Impulsive, Moody, Curious, Unsophisticated as Children, that Wander Over the Plains of Eastern Colombia

By SIDNEY F. TYLER, Jr.

Mr. Tyler went to South America in July, 1928, as historian and photographer of the Tyler Duida Expedition, which is making intensive collections of the natural history specimens of the region and gathering all available geological and topographical data. The expedition had spent no more than a month at its almost inaccessible destination, when the illness of Mr. Hitchcock, the expedition's topographer and geologist, necessitated his temporary withdrawal in search of medical assistance, there being none of any kind available in the vicinity. Mr. G. H. H. Tate, leader of the expedition, was aware that a doctor was exploring on the Orinoco 400 miles below Mt. Duida, and therefore thought it advisable that Mr. Hitchcock should depart in search of him without delay. Mr. Tyler was asked to accompany Mr. Hitchcock on the long journey. A canoe and five Indians were procured, with whose assistance the two men soon reached the physician. It was here that an infection developed that brought about Mr. Tyler's return to the United States. While they were both under the doctor's care, they accompanied him on a short trip up the Tomo River in search of the Guahibo Indians.—The Editors.

EIGHT hundred miles above the mouth of the Orinoco, which forms the boundary between Venezuela and Colombia, lies the drowsy village of Perico. It consists of forty clay and palm-thatch hovels modestly huddled together, wherein some two hundred half-breed peons drag out a weary existence. It was from this village that our small party set out in search of the Guahibos, a tribe of Indians that was said to wander semi-nomadically over the plains of eastern Colombia. We numbered ten persons: five peons, four Americans, and a jovial Danish guide of true Falstaffian proportions.

The equatorial sun shone brilliantly on the lazy waters of the Orinoco. Its glassy surface, motionless beneath the weight of a stagnant and breathless atmosphere, reflected with colorful fidelity the scattered bursts of purple and yellow bloom, the

MR. TYLER IN CAMP NEAR THE ORINOCO RIVER
After five days of traveling in a simple native dugout, the expedition discovered a group of Indian rafts. Camp was pitched at once in the hope of discovering also the owners of the rafts

playful lights and shadows of an impenetrable vegetation, and its dainty, lacelike silhouette. A thick barrier of shrubs and tough marine plants stretched endlessly along the water's edge, behind which rose in impressive grandeur the imposing trunks of great tropical trees. Their limbs were festooned with a curtain of dogged parasitic vines which fell in tangled and riotous profusion to the ground. Macaws, parrots, parrakeets, and all the garish company of Venezuelan bird life darted restlessly to and fro, screaming and chattering harshly as they flew. Their bright colors relieved the jungle's interminable greenness and their unmistakable *joie de vivre* dispelled its loneliness and oppressive silence.

The vessel in which we were traveling was a simple native dugout laboriously and crudely fashioned from the hollowed trunk of a single tree. Its length did not exceed thirty feet. Into this were loaded bags and boxes of every conceivable shape, on the lids of which we took a cramped and precarious seat. To us who crouched in this fashion for so many hours, and to the peons who paddled so tirelessly, the long days seemed unending; for the sun beat down upon our unsheltered heads with pitiless intensity, and swarms of insects transformed our hands and faces into raw and smarting flesh.

On the morning of the fifth day we quitted the Orinoco for the all but motionless waters of the Tomo, a small river which flows in a northeasterly direction from Colombia. Late in the afternoon the sharp eyes of one of the peons discerned within the thick tangle of the bank several gray objects half buried beneath heaps of dead leaves. We landed and investigated. They consisted each of a dozen parallel poles of moriche palm, a wood which is extremely soft. Driven at right angles through these poles were two narrow hard-

wood stakes, one at each end, which served efficiently as long nails. It was obvious that we had stumbled blindly upon a group of Indian rafts; their discovery was our first clue to the whereabouts of savages.

Camp was pitched and a large fire lighted with the hope of attracting any Indians in the vicinity. None came that night. The following morning, while we were preoccupied with the business of breakfast, a slight rustling caught my ears. I glanced over my shoulder and there to my amazement I beheld the motionless forms of twenty Indians stonily observing our actions. In the dim and intercepted light of sunrise they were scarcely visible, especially since not a ripple of motion disturbed their statuesque alignment. They uttered no sound, and it was still too dark to take note of their expressions.

We advanced at once to greet them. They responded with suddenness to our demonstration of friendship by leaping and crowding frantically about us and by pressing forward to touch hands. This done, they turned their energies to a searching examination of our clothes and personal effects. Mystery and astonishment struggled for supremacy in their bewildered countenances. The culinary implements and the brightly labelled bottles and jars of American canned goods seemed to attract them most; several of the bolder spirits indicated their delight by deftly concealing some of the gaudier tins in the encircling underbrush, a maneuver which exacted our unceasing vigilance.

The chocolate color of their bodies blended so perfectly with the shadows and dirty greens and browns of the surrounding forest that even in the growing light they were, when motionless, almost indistinguishable. They were uniformly short in stature, the tallest of them not exceed-

A FIRST GLIMPSE OF GUAHIBOS

Although a fire lighted at night apparently failed to attract the attention of any Indians, the following morning twenty of them appeared silently in the bushes about the camp

CARRYING THE EXPEDITION'S BELONGINGS

Though the average height of these Indians is barely more than five feet, they do not hesitate to carry great weights. They almost invariably travel in single file and usually at a great pace—a kind of jog trot

ing five and one half feet. Feline litheness and grace marked their movements. Their glistening bodies, naked save for a loin cloth, were superbly developed, although many exhibited the swollen abdomens of hookworm and the scars of numberless infections. Beards and mustaches were conspicuous by their absence. The gloss of their straight black hair falling thickly to their shoulders, the narrowness of their small, restless eyes, and the undue prominence of their cheekbones, gave to each head an unmistakable Mongolian stamp.

The behavior of an old Indian with a cigarette marked his tribe as one of the very few in South America unfamiliar with tobacco. He insisted upon tearing one end of it apart to examine its contents. His curiosity at length appeased, he placed the torn and ragged portion to his lips and lighted it with a brand from the fire. In consequence of the harsh treatment which it had received, the cigarette could not be made to draw properly, to the owner's huge disgust. The loose tobacco, furthermore, came apart, and filled his mouth with fragments bitter to the taste; whereupon, after a few ineffectual puffs, he rose and cast it disdainfully into the fire.

The distribution of Mr. Woolworth's finest brass bracelets was received with boundless enthusiasm. Loud cries of "*Caripana!*" rent the air. The Guahibos —for such they proved to be—required no further inducement to snatch our baggage and set off for their village. Securing their loads by means of broad lianas slung across the forehead and shoulders, they departed in high glee, chattering hoarsely among themselves. The individual burdens amounted in some cases to seventy-five pounds, but the ease with

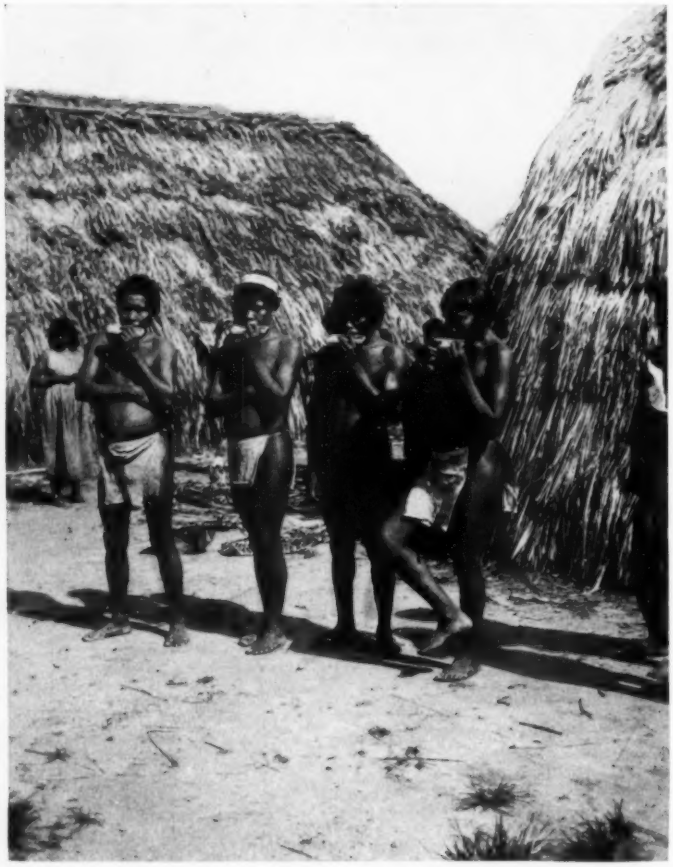
which they bore them and the rapid pace which, in single file, they re entlessly maintained, seemed to give the scales the lie.

For six miles beneath a scorching sun we followed the well-worn trail across arid savannas. At last the village came into view. From a distance it resembled a group of stubby, yellow mushrooms, nestling snugly in the withered grass. The delusion persisted until our arrival. It was situated on the edge of the savannas with a thin border of jungle a hundred yards behind it. Six large huts were grouped about a seventh, this last belonging presumably to the chief. The dimensions of all were alike, approximating seventy-five feet in length, twenty in width, and twelve in height, each hut being solidly constructed of closely woven palm leaves and stems. They seemed quite capable of withstanding the torrential winds and rains which occur so often throughout the Orinoco basin.

The entire tribe, numbering at the outside three hundred, had assembled to witness our arrival. There were the long files of athletic males peering in silent astonishment upon the strangely garbed beings approaching them,—the bright sun flashing and sparkling upon their feathered ornaments and bronze bodies; there were the dirty, unkempt women, their harsh voices momentarily hushed, snatching a few moments of welcome relief from their endless labors to gaze from behind the forms of their august husbands upon this unprecedented event; and there were the groups of small, round-eyed children, clinging in nervous excitement to the rags and tatters of their mothers' garments. Well in advance of the multitude, where he occupied a position in accordance with his rank, stood the thin but wiry form of the chief, his face heavily checkered with broad daubs of red paint, and in his hand a wooden scepter bearing the crude,

IN THE GUAHIBO VILLAGE

From a distance the seven large huts of which the village is composed resembled a group of stubby, yellow mushrooms. They are solidly constructed, however, and can withstand heavy winds and rain



HARMONICAS CREATED ENORMOUS INTEREST
As soon as these ten-cent-store harmonicas were distributed, bedlam broke loose. The second Indian from the left is the "heir to the throne" of the Guahibos

mysterious carvings which symbolized his office. His stalwart carriage and commanding mien betokened the forcefulness of his character.

The silence which remained unbroken throughout the brief formalities of reception impressively bespoke the discipline which the old chieftain enforced. There was neither sound nor movement among the assembled ranks as he muttered a few incomprehensible words and with lofty dignity nodded in sign of welcome. In return we presented him with an elaborate necklace of glittering beads, also from the house of Woolworth, which he donned without acknowledgment or change of expression. These brief courtesies terminated, he turned toward the multitude and with imperious gesture solemnly beckoned us to follow. To one of the huts he led us, through dense ranks of gaping, motionless Indians. His official functions thus completed, he promptly left us to ourselves.

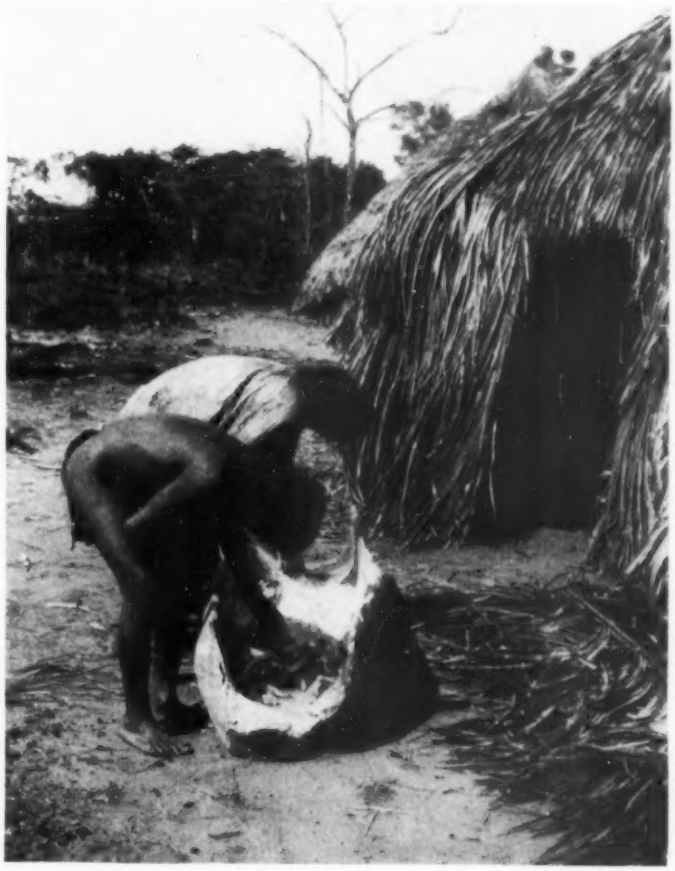
It was indeed a relief to escape the scrutiny of the gathering outside. We found ourselves in a huge chamber which ran without partitions the entire length of the edifice. Neither benches, hammocks, nor other articles were in evidence. The floor was of plain dirt, and the walls were so closely thatched that not a single beam of light succeeded in filtering through. The small size of the two entrances severely restricted the circulation of air, a condition which the heat and filth of the interior rendered almost unbearable. From the absence of any indications of former occupancy we judged this hut to be reserved for councils and important tribal meetings.

The discipline which had ruled the assembled Guahibos vanished completely upon the withdrawal of their chief; and the scene which had occurred in camp that morning was reënacted in our hut upon an infinitely greater scale. They swarmed into the structure and filled it to the limit of its capacity. Men and women vied with one another in striving for a closer view and in fingering our persons

and possessions, at the same time panting loudly from their exertions. In the presence of this gallery of constantly changing faces peering at us with such insatiable curiosity, we felt like the principal exhibit of a museum, or, more accurately, of a circus "side-show." Through the almost opaque darkness came the immense murmur of countless voices sibilantly whispering. Blasts of hot breath smote our faces. But worse than the heat and darkness and confusion of the situation was the pungent odor of overheated and underlaved women fresh from their labors in the fields and domestic toil.

When the excitement caused by our arrival had subsided, and the normal life of the village had been in some measure resumed, we strolled leisurely through some of the adjacent huts. To each there were, roughly, fifty inmates. The men reclined indolently in their palm-fiber hammocks, comatosely indifferent to stranger and family, lacking energy even to brush the plagues of flies from their faces; small boys played casually in the mud; while the women, assisted by the girls, in accordance with the immemorial custom of tribal people, labored mightily under their husbands' eyes at the preparation of cassava and at other menial occupations. The air was heavy with nauseating odors. Hammocks dangled idly from walls and roof, and simple baskets and wooden bowls lay scattered about in aimless confusion. Everywhere there was poverty, squalor, filth.

The lassitude of these people, remarkable even for Indians, resulted principally from a dangerous habit that was rapidly bringing about their destruction. From the leaves of the *Erythroxylum coca*, which they desiccate, pulverize, and then mix with wood ashes, they obtain a substance which possesses powerful narcotic qualities. Frequently we saw them, women as well as men, inhaling the yellow powder by means of a highly painted snuffer, a strange tool which they fashioned from the hollow leg-bones of deer. It was this practice more than anything



GRINDING MANIOC

As in the case of many other South American Indian tribes, the Guahibos use manioc as a staple food. From these roots they prepare cassava. The man in the picture, though he appears to be working, is in reality merely superintending his wife's labors

else that rendered them lazy to the point of insensibility and destroyed so thoroughly the possibility of mental effort. It made them the constant prey of hardier tribes who swept irresistibly down from the encircling hills to plunder and pillage at will; and it accounted for the lowness of their cultural level, the absence of morals, and in general the bestial conditions amid which they lived. Indeed, unless a speedier and more vicious fate in the guise of the white man's conquest should overtake them, their addiction to this drug spells extermination.

That night we visited the chief and rewarded him substantially for countenancing our observations and photography. We presented him with a large knife and an assortment of bells and rattles such as would have delighted the heart of any ten-months-old child. One stirred his martial ardor and the other flattered his vanity and rhythmic ear. In recognition of this he turned to one of his numerous wives and ordered her to fetch the contents of a wooden bowl which stood in a corner near at hand. She brought a foam-bespattered, beery liquid, which she had transferred to a skilfully woven palm-leaf receptacle. At sight of this we shuddered, and then bravely gulped down as small a quantity as was consistent with politeness. It was *chicha*, warm and indescribably bitter, a fermented liquor that is imbibed only at monthly tribal feasts and on occasions of great moment. The manner of its preparation is revolting. The women of the tribe, having ground yucca roots to a sticky paste, fill their cheeks with it and chew it. It stimulates the salivary glands, with the result that the women continually expectorate into a common bowl provided for the purpose. This is the well-known *chicha*, common among most of the tribes of South America. As the foul liquor coursed hotly down our throats, each of us ruefully speculated upon the genus and contagiousness of the bacteria which we were absorbing.

The overwhelming preponderance of women over men, a condition which resulted from the frequent predatory raids of neighboring tribes, was responsible for the low opinion of the former which the male Guahibos universally entertained. Under the surveillance of their overlords, to whom was reserved the pleasurable pastime of shooting fish and game, the women of the tribe devoted themselves to the painful drudgery of gathering yucca roots, otherwise known as manioc, and converting them into the indispensable cassava. Yucca is a starchy, purple substance not unlike our potato, which forms throughout the year the staple article of their diet. The existence of the tribe depends upon it, for it yields them at once their food, their alcohol, and their poison for tipping arrows.

The women first rubbed the yucca up and down inside a wooden trough, the interior of which was rough and furrowed with ridges, until the allotted supply had been reduced to a moist paste. It was back-breaking work, for the trough lay on the ground and the women for hours at a time were obliged to bend nearly double. In this state the yucca was transferred to a narrow, cylindrical wooden bowl where, by means of a heavy pole, the poisonous juice was expressed. The third step in the process was the removal of the paste to shallow palm-fiber baskets about eighteen inches in diameter. Water was added and the baskets were then placed in the sun for their contents to rise. Finally the yucca was roasted over a huge fire and set aside to cool. The result was a coarse, hard, breadlike substance that resembled a gigantic gray buckwheat cake. If taken with water, it possessed a very agreeable flavor.

But the most striking instance of the male's adamant disregard for his wives

A VERY PRIMITIVE MEANS OF NAVIGATION
This inadequate little raft, which barely supports the wielder of the paddle, forces the navigator to sit in the water. More primitive "boats" than this hardly could exist

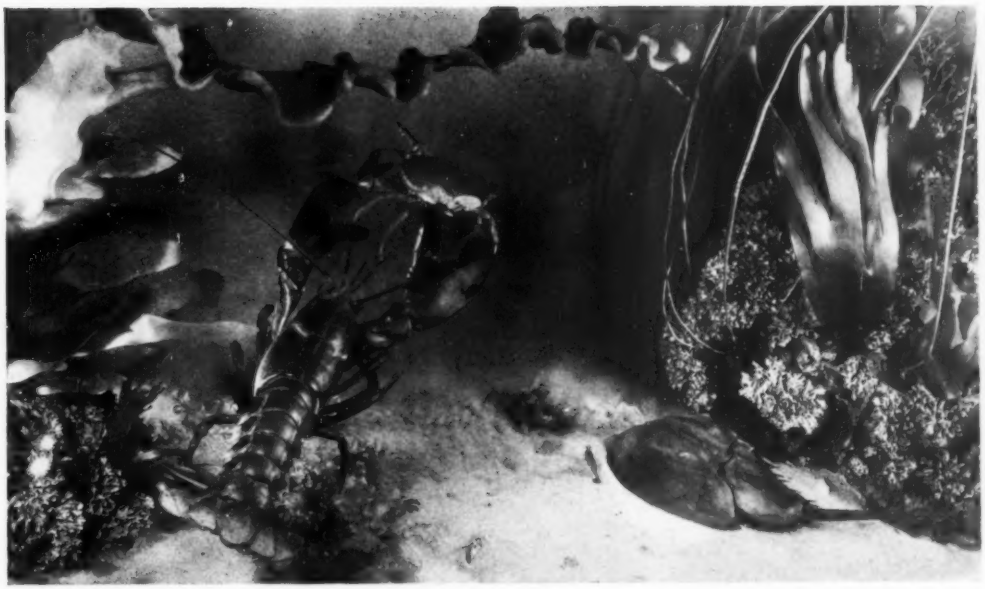
was an event that occurred a few hours prior to our departure. It happened immediately before our eyes, but so rapidly that remonstrances or more cogent arguments on our part were impossible. A young Guahibo ordered one of his older wives to prepare additional cassava. He left his hut and returned a few minutes later to find that the work had not yet been commenced. Incensed at such flagrant insubordination, he seized one of the knives which we had given him and threw himself bodily upon the unfortunate offender. The struggle terminated only after he had in cold blood slit wide open the crown of the woman's head. Cleaning the weapon by plunging it into the damp earth, he repaired nonchalantly to a neighboring hut where he proceeded to solace himself in the company of one of his other wives. Had we not had with us the services of a capable doctor who promptly sewed up the gaping wound, the woman would undoubtedly have bled to death. But to her callous husband the outcome in either case would have been of little moment; did he not possess an abundance of wives and dependents who could easily minister to his whims and needs?

To us, however, who appeared to these savages doubtless as creatures sent from another world to being them gifts, they showed only the better side of their natures. In their exuberance, artlessness, and impulsive ways, there was undeniable charm. Unsophisticated children they truly were, with all the variable moods and flights of fancy, the flashes of enthusiasm followed by depths of languor and despair, and then again the fits and starts of a restless curiosity which refused to be satisfied. They seemed so perfectly contented with their lot, so utterly oblivious to the world which throbbed outside, and to the possibility that

some day the white man would descend to put an end to their freedom and time-honored tribal life, that one contemplated with a pang the fate which must inevitably overtake them.

There could be no better example of the playful unstableness of their natures than the contrast which, in spite of an uninterrupted shower of gifts, marked the scenes of our departure with those of our arrival. In place of the wild singing and shouting, the vast, immeasurable curiosity, there was now an atmosphere of ill-concealed relief. Perhaps the constant glitter of many-colored beads and bracelets or the gleam of highly polished knives, had dazzled their eyes and dulled for a time their senses. In silence they bore our baggage back to the canoes; their wild natures could no longer brook the presence in their midst of a disturbing, if benevolent, element.

THE EXPEDITION PREPARES FOR ITS DEPARTURE
The Guahibos were delighted to receive the visitors, but lost their interest after the gifts had been distributed



Animals of a submerged sandy sea floor

OUTPOSTS OF THE SEA

The Animals of the Tidal Realm—Marine Hosts that Today Assail Our Continental Borders, Endeavoring to Repeat the Conquest Attained Ages Ago by the Ancestors of the Present Land-animals

By ROY WALDO MINER
Curator of Marine Life, American Museum of Natural History

THE daily rise and fall of the tides along the seacoast alternately submerges and lays bare a strip of the shore which varies in width from place to place according to the local range of the tide.

Thus, the vertical rise of the tides off the New England coast south of Cape Cod is only from one to two feet. Within Cape Cod Bay and Massachusetts Bay, on the other hand, it rises nine to ten feet. This is also true along the Maine coast, where the tides are deflected to the northwest by the curvature of the shore, joining the incoming waters farther north. These, in turn, are finally compressed into the narrowing funnel of the Bay of Fundy with the result that huge tides of thirty to forty feet are created at its tip.

In Passamaquoddy Bay, New Brunswick, the rise is twenty-two feet, and this is the extent to which it covers the vertical cliff-walls of Bliss Island, at the entrance to the bay. St. Andrews Point, within the same bay, has a very gradual slope, and, at low water, is uncovered for two miles. Hence, the tidal zone varies greatly in area.

The nature of the substratum composing it also differs. It may be of rock in the form of vertical cliffs, as above mentioned, or sloping and, perhaps, broken into terraces. On the exposed shores it may consist of sand beaches, or mud flats in sheltered coves and bays. It may be covered by rocky bowlders, broken down from the cliffs by wave action, or eroded out from headlands of glacial drift by the washing away of the soil enclosing them.

The animal and plant life of the permanently submerged continental shelf has oveflowed into this stretch of semi-

Photograph by Mary C. Dickerson

A SAND BEACH AT LOW TIDE, WOODS HOLE, MASSACHUSETTS
Long lines of seaweed, thrown up by the waves, are arranged in ribbon-like bands, beneath which sand hoppers and beach fleas are concealed

terrestrial, semi-marine territory. The continental shelf is the submarine continuation of the tidal zone seaward. It slopes gradually to about one hundred fathoms, beyond which the bottom falls more rapidly to the greater depths of the ocean. This outer face of the shelf is known as the continental slope, and varies in its abruptness from a clifflike drop to a gradually accelerated gradient continuing the surface of the shelf itself. The width of the continental shelf also varies considerably. It is extremely wide in the North Atlantic, from the American side around to the British Isles, but quite narrow off Spain and Portugal and the western coast of Africa.

It is believed that the comparatively shallow waters of the continental shelf and slope witnessed the great evolution of marine life. Here it became diversified and abundant, for here the conditions of life are at their best. From this region marine creatures were crowded out into the deeper oceanic waters, on the one hand, or specialized for the pressures and darkness of the deep abysses. On the other hand, they invaded the tidal zone, the fresh waters and, finally, the land. The evidence is strong that wherever and whenever life originated, the continental shelf is the region of its greatest evolution and the center of its radiation. The very fact that its location has shifted during geologic ages, as the continental areas were thrust upward or were worn down again through erosion, until the continental shelf invaded their lower reaches as epi-continental seas, has caused the living creatures inhabiting the shallow waters to be subjected to varying conditions and an intense struggle for existence, resulting in the preservation of adaptive changes and the elimination of those that were nonadaptive. As we see it now, the tidal zone and its inhabitants

represent a present-day phase of that struggle, for here only those sea creatures can exist that are adapted to the strenuous daily changes of environment involved in being alternately exposed to the air and submerged by the tidal flow. It is so striking an example of the results of natural selection on a large scale, and so accessible to everyone, that the thinking visitor to the shore will have no difficulty in reading the chief lessons taught by the inhabitants of the tidal region.

In the first place, it must be remembered that the tidal zone is the pulsating border of the great life-association of the submerged continental shelf. Secondly, life is so abundant that animals and plants of all species not only live where conditions are appropriate and easy for them, but also struggle to live under adverse circumstances. Those that inhabit the totally submerged shallow seas find life comparatively easy, exposed as they are to the sunlight, yet covered by oceanic waters chemically harmonious with their body fluids—a fluid hydrosphere filled with food and replete with oxygen for the animals, and carbon dioxide for the plant life. Nevertheless, many also struggle to live under the more trying conditions of the tidal zone, where they maintain their position in proportion to their hardiness and their capacity to withstand exposure.

Everyone who walks along the shore at low tide is familiar with the zonal or banded distribution of the animal and plant forms. This is especially conspicuous on the rocky shores of New England, north of Cape Cod. The white band of rock barnacles (*Balanus bala-*

THE CLIFFS AT NAHANT, MASSACHUSETTS, AT LOW TIDE

The tidal zone is clearly marked on the vertical rocky face, as a band nine feet in width, showing the white frieze of barnacles above the stratum of seed mussels and rockweed which extends to the water line. A rock tide-pool, overarched by a weed-festooned natural bridge, is shown in the foreground. This locality is reproduced in the American Museum as the "Tide-Pool Group"

A CROWDED COLONY OF MUSSELS AND BARNACLES
Both mussels and barnacles can withstand long exposure to the air by enclosing enough sea water within their shells to keep their breathing organs moist. Together with the periwinkles (*Littorina litorea*) and "purple" snails (*Thais lapillus*), they invade the upper regions of the tidal zone. The snails, especially, suggest a transitional stage toward terrestrial life

noides) is displayed at the summit of the zone, their close-set marble wigwams crowding each other to form a snowy frieze. Ambitious periwinkles (*Littorina litorea*) swarm here and there, climbing slowly but surely upward over the housetops of the barnacle colony, and even mounting far up the bare rocks above it.

The barnacle frieze is overlapped below by the rockweeds (*Ascophyllum nodosum* and *Fucus vesiculosus*), their olive-brown fronds draped in graceful fringes down to the water's edge, disclosing beneath their parting masses the continuous embossed mosaic of the black edible mussel (*Mytilus edulis*), which encrusts the rock up to the lower limit of the barnacle zone. Bright patches of gaily colored and banded "purple" snails (*Thais lapillus*) may be seen grouped upon the mussel colony, which extends downward and below the water mark. Here it is succeeded in turn by another zone characterized by the green sea urchin, a small animal rejoicing in one of the longest scientific names known to zoölogy, *Strongylocentrotus droehbachiensis*.

The sea plants below the rockweed zone include the common pink coralline (*Corallina officinalis*), the Irish moss (*Chondrus crispus*), and the dulse (*Rhodymenia palmata*). These are laid bare only by the lowest tides, and even then are continuously washed by the surf. Also at this level the two species of the common sea star (*Asterias vulgaris* and *Asterias forbesi*) are to be found, the former varying in color through red, orange, purple, and blue, and distinguished by a white spot, the ambulacral plate, between two of its arms. The latter is usually greenish brown, with a bright orange ambulacral plate. Associated with them are the common sea anemone (*Metridium dianthus*) and two species of rock crab (*Cancer borealis* and *Cancer irroratus*).

This zonal arrangement depends upon two main factors, the exposure factor

and the food factor. It is obvious that the height above the low-water mark at which a sea animal can live depends upon its ability to withstand exposure to the air, for the upper limits of the tidal zone are, of course, left bare the longest. The periwinkle, in fact, is far on the way toward adaptation to terrestrial life. As the tide falls, it captures a few drops of water, which bathe its breathing organs and are kept from evaporation by a closely fitting horny plate closing the shell-opening. In this way it may remain many hours out of water. It is a vegetarian, feeding not only on the surface of rockweed, but also on minute algæ high on the rocks and among the barnacles.

The barnacles likewise are provided with means of retaining a few drops of moisture or moistened air beneath four little valvelike plates that close the top of their shells. They feed on the microscopic diatoms brought on the crest of the incoming tide. When they are submerged, each barnacle may be seen to unfold its quadripartite doors, whereupon the little plume of feathery feet waves to and fro, and, like a casting net, captures its tiny prey, which is immediately withdrawn within the closing gates. Agassiz has said that a barnacle is nothing but a shrimp standing on its head within a marble house, kicking its food into its mouth with its feet!

The mussels, occupying the zone immediately below the barnacles, can withstand exposure, but for a shorter time. They, too, feed upon diatoms. Both mussels and barnacles are preyed upon by the voracious "purple" snails, which also can withstand exposure at low tide, though many remain hidden under the moist drapings of rockweed.

The mussel zone is limited above by the barnacles, which tend to spread over the mussel shells and choke them by their more rapid growth, and below, by the zone of green sea urchins, which feed

COLLECTING IN THE TIDE POOL AT NAHANT, MASSACHUSETTS

Basins and crevices in the rocks remain filled with water when the tide falls below their level, and thus harbor not only the life of their own zone, but also many creatures which ordinarily live below the low-tide mark

upon the mussels. The latter are also preyed upon by dog whelks (*Buccinum undatum* and *Lithodomus decemcostata*), two large snails found on our northern rocky shores. The whelks bore round holes into the mussel shells and suck out the animal.

Down near the low-water line voracious sea stars envelop the mussels with their arms, attaching their tube feet to the opposing valves, which they pull apart by gaining a purchase with their arm tips on the surrounding substratum. Then each sea star protrudes its saclike stomach from the central mouth on the underside of its body, and inserting it between the valves of the mussel, pours out its digestive fluid. Thus, it digests the poor creature within its own shells, while it absorbs the fluid products of digestion through its stomach walls. Sea stars devour oysters even more voraciously, and are the most hated enemies of the oyster fisherman.

On terraced and sloping rocky shores there are many crevices and basins that are left filled with water at low tide. These occur at various levels and, in the lower part of the tidal zone, are especially rich in concentrated animal and plant life appropriate to the level at which they occur, and also to all the zones below that level. At flood tide they are invaded by the eggs and larvæ of many creatures usually found only below the low-water mark, which are able to live and develop in the pools because these are always filled with water. Thus the pools become veritable sea gardens of great beauty and fertility.

Here gay-colored sea stars occur in great abundance, hiding in crevices between bowlders covered with velvety brown Irish moss glimmering with iri-

Photograph by Mary C. Dickerson

A SEA ANEMONE WITH BEAUTIFULLY EXPANDED TENTACLES

These flower-like animals (*Metridium dianthus*) live at or below the low-water mark, often in great numbers. Their petal-like circlets of tentacles are armed with sting cells and surround a central mouth. Free-swimming creatures, including small fishes, are caught, stung to death, and devoured. The anemones vary widely in color, from brown through pink, cream, white, and deep orange

descent violet tips and overhung with clustered chimneys of the gray-green crumb-of-bread sponge (*Halichondria panicea*). Feathery, ruby-hearted hydroids (*Tubularia crocea*) fringe a shelf occupied by sea anemones with their rich stock-in-trade of color, ranging from brown, mottled with white, through plain white to rich pink and deep orange.

Two green crabs (*Carcinides mænas*) are sparring with each other in a corner beneath the ruffled overhanging fronds of the brown kelp (*Laminaria agardhii*). The entire rock surface, lining the pool, is gay with sea mosses or encrusted with red-purple and brown calcareous algæ. Thus the pool is replete with life, refreshed and renewed by the periodic incoming tides with their floods of food and oxygen.

Photograph by Mary C. Dickerson

PERIWINKLES AND SEA STARS EXPOSED AT LOW WATER

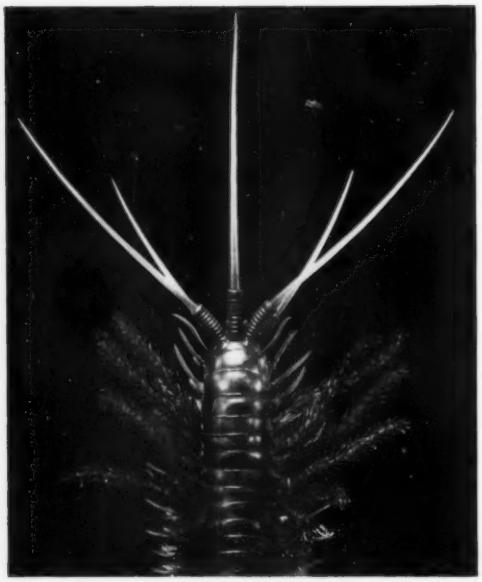
The ubiquitous periwinkles are abundant near the low-water mark, as well as in the upper reaches of the tidal zone. The sea stars, on the other hand, can withstand exposure for only a short time, and are therefore confined to the lower part of the tidal zone and the waters below the low-tide mark

While the northern New England shore is characterized by its rock-bound coasts, sandy beaches occur here and there, hemmed in by granite headlands, and mud flats are found in sheltered locations. But southern New England is typically low and sandy, beginning with the great sand spit which is Cape Cod. This forms a barrier hindering, to a degree, the intermingling of northern and southern forms.

Animals of the rocky coasts and regions of high tides must be adapted for clinging to crevices and for withstanding the battering of the waves and the rush of tidal currents. Animals of sandy and muddy regions, on the other hand, tend to be of burrowing habits, while the surface-living creatures are scavengers.

A sand beach, at low tide, appears to be a particularly barren place. Yet the close observer will detect signs of life. For example, he may chance upon little heaps of sand here and there, which betray the presence of the sand-collar snail (*Natica duplicata*).

If one waits till the tide begins to rise and covers these burrows, a stirring of the sand may be seen, and soon the snail will issue forth and crawl slowly over the



THE PLUMED WORM

This martial looking knight (*Diopatra cuprea*), of the sea bottom, lives in a chimney-like den, the upper portion of which projects into the water above the ocean floor

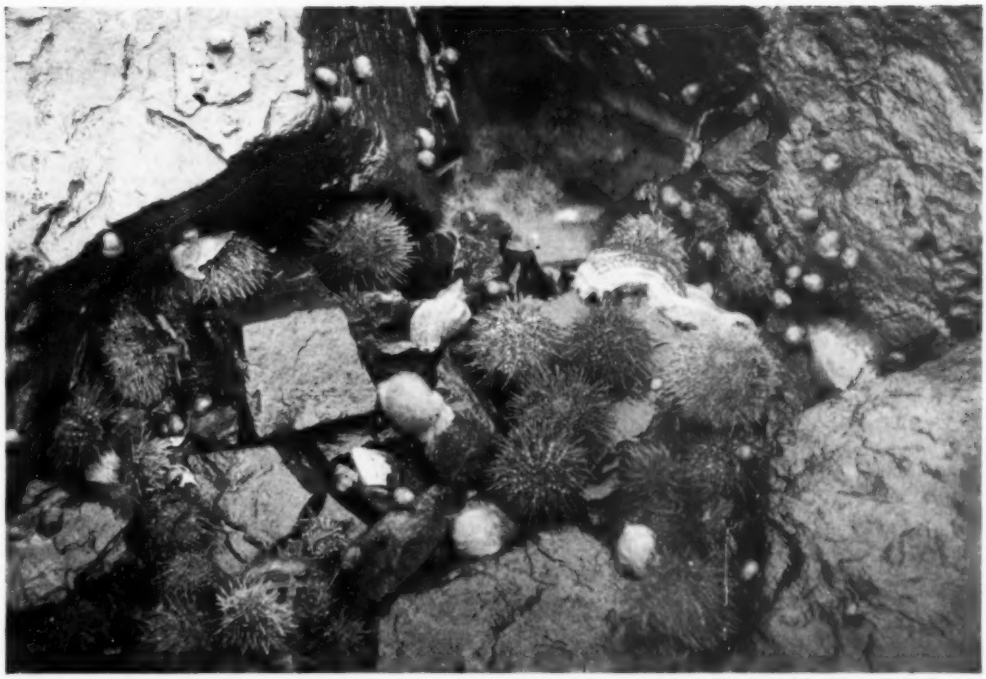
sea bottom. As it unfolds its foot and expands its "apron," it seems impossible that so huge a creature could have been packed into a spherical shell the size of a tennis ball. Above the apron it waves a pair of tapering tentacles, furnished with eyespots near the base.

The egg-case of this snail is a flat, nearly circular, collar-shaped structure, to which the sand adheres. The underside is completely lined with transparent, beadlike eggs. These sand collars are often picked up on the beach in a dry condition, when they crumble at a touch.

Other burrowing animals of the sand beach are the razor-shell clam (*Ensis directus*), so called from its elongate bivalve shell suggesting the handle of an old-fashioned razor; the lady crab (*Ovalipes ocellatus*), a swimming crab with hind legs terminating in oval paddles and a carapace beautifuly marked with

A FLEET-FOOTED INHABITANT OF SAND BEACHES

The ghost crab (*Ocypoda albicans*) is aptly termed, for its light, sandy markings so closely resemble the color of the beach, that it flits like a shadow along the shore and seems actually to disappear from the sight of the observer when it comes to rest



Photograph by Mary C. Dickerson

A COLONY OF GREEN SEA URCHINS

These sea urchins (*Strongylocentrotus droehbachiensis*) are abundant at or below the low-water mark on our northern rocky coasts. They feed upon the edible mussels (*Mytilus edulis*) and both, in turn, become the prey of the voracious sea stars (*Asterias vulgaris* and *forbesi*)

small purplish spots; and the ghost crab (*Ocypoda albicans*), found on sandy beaches from Long Island southward. This crab makes its burrows above the low-water mark and its whitish carapace so closely imitates the sand that it is difficult to see it, except when in motion. It runs with great speed, and, when it stops, seems to disappear.

Mud flats are especially rich in sea life. Everyone is familiar with the great stretches of edible mussels (*Mytilus edulis*) that are found on certain mud flats between the tides, and the kind of sandy mud in which one digs for clams, whether the soft clam (*Mya arenaria*), or the "hard shell" (*Venus mercenaria*).

But let us take a water glass (which is just a bucket with a glass bottom), and wade at low tide in a sheltered cove near the edge of a patch of eelgrass. Where the shallow sea floor is composed

A MEMBER OF THE STREET-CLEANING FORCE OF SHALLOW WATERS

The hermit crab (*Pagurus pollicaris*) is one of the scavengers of submerged, muddy sea bottoms

SEA STAR DEVOURING OYSTERS

The sea star mounts the shells of the living oyster with its five arms partly enfolding the two valves of its victim. It then applies its hundreds of tube-feet to the outer surface of the shells by means of small terminal suckers. With the tips of its arms it braces itself against the surrounding objects and exerts a strong, steady pull, that gradually forces the oyster shells apart

of sandy mud, let us place the water glass on the surface and look through it. A busy scene at the edge of a miniature submarine forest composed of the eelgrass roots, is disclosed to our eyes. Tiny hermit crabs (*Pagurus longicarpus*) are scuttling to and fro. Soon they gather about a bit of decaying substance and immediately begin to pull it apart. Mud snails (*Nassa obsoleta*), attracted by the tumult, crawl up from various quarters, leaving a little groovelike track in the mud behind them. A larger hermit (*Pagurus pollicaris*) lumbers along and scatters the smaller fry as he pulls the decaying morsel to pieces. Small, transparent shrimp (*Palæmonetes vulgaris*) dart in to get their share.

The hermits, the shrimp, and the mud snails are the scavengers of shallow water —the street-cleaning department of the submerged mud flat—and they are thorough in their work. It is true that the hermits acquire their uniforms by theft, for they appropriate the shells of sea snails. Sometimes they find them empty and ready for use. At other times, they are said to eat out the former occupant first, thus obtaining a meal and a home simultaneously. When they grow too large for the shell they happen to have, they hunt for another, and it is amusing to see them make the change. They leave the old shell and, quickly settling into the new one, try it a few seconds, then change back to the old home. After a short interval the new shell is tried again, and the process is repeated several times. In the end, the hermit may walk off with the old shell after all!

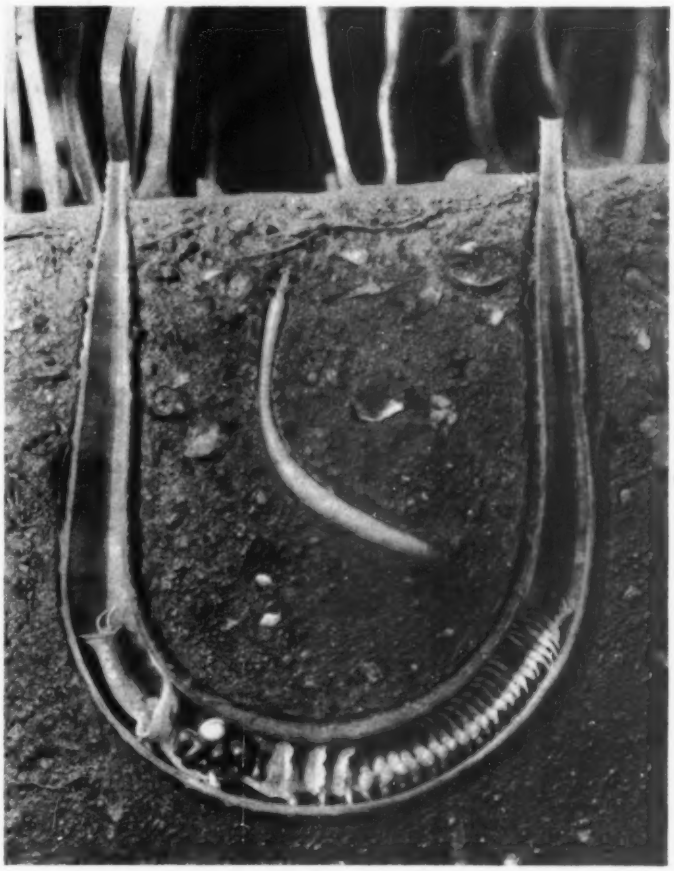
We now direct our gaze at the shallow

sea floor in the clear space between the eelgrass and the shore. Here on the sandy mud we begin to see certain details that hitherto have escaped our attention. Clusters of broken shell and bits of seaweed, apparently caught together by the currents, now resolve themselves into neatly cemented chimneys leading to some underground abode, for gently waving filaments projecting from the summit betray the existence of an occupant.

We carefully dig down into the sea bottom around the structure and remove a long, tapering, parchment-like tube, with the thickened chimney of shell-fragments at the top. After washing it, we cut it open in a glass dish of sea water, and out floats a beautiful, struggling creature, clad in segmented steel-blue armor, and bearing several sets of blood-red plumes upon its shoulders, while five tapering, lancelike palps are flourished in front. This knight of the submarine castle is the plumed worm (*Diopatra cupræa*).

Likewise, paired chimneys of smoother texture a little nearer the shore cause us to dig up a U-shaped tube, also of parchment, belonging to the parchment worm (*Chætopterus variopedatus*). This is the most curious worm of all. It is a strange creature with a flat, shovel-like head, armed with bunches of golden bristles, behind which is a pair of long arms having grooves lined with moving cilia. Then comes a pulsating cup, attached to the upper side of the body, followed by three disc-shaped segments, and last of all is the tapering tail, disclosing through its transparent walls an internal structure brightly colored green, yellow, and pink.

The parchment worm lives in the bottom of its tube, the three disc-shaped segments fitting the cavity neatly. As



A BUILDER OF SUBWAYS BENEATH THE SEA

The parchment worm constructs for itself a U-shaped tube formed of a gluelike secretion from glands in its own body, which hardens into a parchment-like substance upon contact with the sea water. The strange looking architect lives in the bottom of his home, the two chimneys of which project into the sea. By means of three disclike segments in the middle part of its body, which just fit the interior of the tube, the creature pumps a stream of water into one chimney and out through the other, from which it abstracts the microscopic creatures that form its food

ANIMALS OF THE WHARF PILES

The piles of old wharves along our shores are completely covered with a great diversity of animal forms, all of which are adapted to filtering out the microscopic food from the sea water in which they are submerged

the worm contracts its body rhythmically, these segments move like the pistons of a suction pump, drawing a stream of water into one chimney, passing it through the tube, over the body of the worm, and out the other chimney. The microscopic food contained in the sea water is filtered out by the combined action of the arms and moving cup, and transported through a trough lined with moving hairs up the mid-line of the body to the mouth of the worm.

It is obvious that not only the sea bottom, but the soil beneath the sea as well, is alive with myriads of creatures, adapted by their structure for breathing and obtaining their food in this particular habitat. Likewise, if we examine the wharf piles of an old wharf, we shall find it clothed completely with sea grapes, tube-building worms of brilliant, flower-like hues, feathery hydroids, scarlet sponges, mussels, sea anemones, members of every animal phylum, all adapted to a stationary form of existence, equipped with various contrivances for extracting minute creatures for food from the life-giving sea in which they are bathed.

Life pulsates wherever we search along the borders of the sea. Living creatures endeavor to occupy every kind of habitat, and, if it is favorable, swarm through it so vigorously that all the space is occupied and many are crowded to the limits where marine life is precarious.

The pressure to escape to an air-breathing existence drives certain species to the limit of the tidal zone, so that we see, at the present time, compromises between the marine and terrestrial form of life, as in the case of the periwinkles and purples among mollusks. These are closely related to other snails (*Ampullaria* and *Siphonaria*) which have both water-

breathing branchiæ and air-breathing lung, and finally the snails, *Cerithidea* and *Cyclophorus*, terminate the series with a complete air-breathing apparatus. The same pressure now continues which, in the Carboniferous Age, forced the conquest of the air by the lowly progenitors of the land vertebrates.

The comparative anatomy of marine invertebrates shows us that there has been a gradual closing of the body cavity and circulatory system in higher marine animals, thus segregating the body-fluid which bathes their tissues and is closely similar in composition to the salt solution that we call sea water. It is very significant that the inorganic salts of the blood of terrestrial animals are the same as those found in the ocean.

Thus the water of the seas, closely adapted in its composition for the life requirements of the lowest marine creatures and circulating freely through their cavities, has been succeeded by a fluid closed off from the outside within the bodies of higher organisms, some of which finally shook themselves free of their ancestral abode and emerged into the upper air. It is almost as if the invaders of the land carried a portion of their original habitat enclosed within them to bathe their tissues with the precious sea environment and so insure their continued existence in their new world.

THE SUN STAR OF OUR NORTHERN SHORES

This brilliant creature, (*Solaster papposus*), bright scarlet with white-banded arms, is one of the most conspicuous inhabitants of our rocky coasts

SEEDS OF DISASTER

The Tragic Account of the Fall of a Thriving Community of Bolivian Umbrella Ants. How the Supplies They Garnered Caused Their Dramatic End

By DAVID LOCKE

WITH FIVE DRAWINGS BY LYNN BOGUE HUNT

In the following article the author has told a story which, in part, is frankly fictionized. It has been carefully read, however, by Prof. William Morton Wheeler, Research Associate in Social Insects, American Museum, and America's outstanding authority on ants, who refers to it as follows:

"It seems to be correct and of interest as showing the variety of food and behavior of Atta. I have some doubts about the last part of the article describing the plundering of the nests and killing of the inhabitants thereof by another colony of Atta. The author's conjectures may be correct, although I have never seen any tendency of Attas to war on their own species or plunder the contents of their fungus chambers."

With this introduction, Natural History Magazine presents it, glad to be able to publish an account so filled with action and interest.—THE EDITORS.

UP and down the sandy streets of Santa Cruz de la Sierra marches Sepi, her green umbrella spread. Through flower-gardened patios and even into neat white-plastered dwellings she blithely takes her course, serenely ignoring the chill welcome with which she is received by the human beings who consider as their private property the territory she invades.

On she marches, her lithe red body borne rapidly along by its six slim legs, toward the rounded dome surmounting the subterranean city wherein the green leaf umbrella will be stored for her fungus gardening. For Miss Sepi of the well-known Umbrella Ant family is a strict believer in the patronizing of home industry, and an ardent advocate of scientific truck farming.

No Battle Creek invalid was ever more fixed in the determination of his diet than is she. No manufacturer of bread or breakfast food can boast more truly than Sepi of "food no human hand has touched." Neither meat nor bread nor anything that grows upon the surface of the earth can tempt her from her home-raised fungus menu.

Leaves, fresh or dry, she prefers for her underground gardening, but other woody things will serve. Rose bushes, vines, and shrubs in Santa Cruz must be surrounded by circular pottery gutters sunk in the ground and filled with water so that the insects cannot cross, or some fine morning the gardener may look out upon his patio and discover that the Sepi army has passed in the night, and that cherished plants have been stripped to bare and desolate stems. Consequently Miss Sepi is not popular with her human neighbors, and many and novel are the schemes which have been devised to get rid of her, yet, despite them all, she thrives and flourishes.

But, all you girls who take to business and professional careers, look upon Sepi and be warned in order that her fate shall not some day overtake the human race. Miss Sepi knows none of the simple joys of family life, nor has she sweetheart or husband or child to cherish. Neither is her way lightened by the prospect of "dates," dances, or movies. Her only pleasure is in her daily toil and the intervening periods of rest from it. By the same token, all you men who complacently look on as these girls usurp your occupation of breadwinner, you, also, beware. For the gentlemen of Sepiland are few, and what may be their fate is not

surely known, unless they furnish armor-plated hams and sides of bacon for some cannibal and unvegetarian sprees of the unloved and unloving "poor working girl."

Our house in Santa Cruz, like innumerable others, was of plaster on a frame of bamboo, unceiled and roofed with tiles. There was a large front room, or sala, which extended entirely across from one adjoining house to the next. Back of this extended in single file a series of other rooms somewhat less than half the sala's width. Beside these rooms ran a tile-roofed gallery, also connected with the sala by a doorway. House and gallery were floored with brick, by no means evenly. Between the gallery and the solid mud and bamboo wall of the neighboring house was the patio which ran back some fifty feet behind our house to a large area in the center of the city block. This patio contained a few rosebushes and other shrubs, two or three papayas, and one tall *algarrobo* tree.

Beneath the gallery eaves sat great earthen jars, half buried in the ground, containing the household supply of rainwater. They contained, in addition, sundry other things such as pink aquatic worms, several types of water bugs including one closely resembling a miniature submarine, and innumerable wiggletails which the local children were sure would grow up into snakes. However, we resolutely refused to think of these things when we drank water.

All Santa Cruz houses had these things, even more and better than our own, for, this being a rent house, it and its patio had been poorly tended. Our house was by no means crowded with furniture either, whereas in even the most ordinary Santa Cruz home the number of chairs and sofas was limited only by available space. We were, therefore, not a little proud that, as an added attraction of our own, the sala boasted a populous Sepi city beneath its floor, the entrances being between the bricks, one large portal and two or three smaller ones. We enjoyed the company of our industrious fellow inhabitants, though they were an endless source of concern to our visitors, who put down our forbearance toward the insects as another of the inscrutable eccentricities of the gringo.

SEPI, OF THE UMBRELLA ANT FAMILY

"Up and down the sandy streets marches Sepi, her green umbrella spread and her lithe red body borne rapidly along by six slim legs"

The Sepis were a busy folk, but they preferred to do their work under cover of darkness. By light of day only half a dozen workers and occasionally a great, square-jawed soldier—perhaps an "M. P."—strolled about the surface, but as dusk came on, the city below began to awaken and the army of industry poured forth and set about their business of collecting and transporting supplies from the patio.

A handful of scouts appeared, darting swiftly about the environs of the city to see that all was clear. Soon there was a busy column of workers streaming across the floor and on to the gallery. Lesser columns diverged from the main one into the patio. Seemingly the order of the day was given before leaving the nest and each knew just which turn she was to take at the branching of the ways. Having reached their field of operations, they would begin the return journey to the city with bits of leaves and twigs and all sorts of odds and ends of wood. The outward bound ants dashed recklessly and with no thought of traffic regulations through the slower-moving bearers coming in. Now and then there was a halt and an exchange of greetings or gossip—if this feminine trait is still retained by the neutered maidens of Sepiland.

If a bearer appeared to have more than she could handle, she was often aided by a passer-by, who either gave her a hand in fixing the load so it could be carried, or, if it was entirely too large for one ant, made the whole return journey as an assistant. Often the efforts of two ants on a load seemed far from coördinated; in fact, it frequently appeared as though each were hindering the other, but somehow they always progressed. Here and there along the way a soldier patrolled slowly beside the column of workers, a creature with a great bulldog head vastly too large for her slim worker-size body. These probably acted as traffic officers, though I never saw an occasion where they exercised their authority by directing the busy column, nor did there ever appear necessity for straightening out a traffic jam.

The habit of the Sepis of throwing down their burdens exactly where they stood when the quitting-time signal was radioed from the nest was rather untidy, for invariably each morning there was a line of assorted bits of trash strewn thickly from the city gates across the sala, over the doorstep and along the gallery, decreasing in volumes as the branch roads ran off into the patio.

At the doorstep of the sala entrance there was always laid aside the greatest heap of freight. Here was the chief obstruction in the Sepi road. Here they struggled ceaselessly to raise their heavy loads over the inch-high, vertical wall of the doorsill. The angle between the floor and the sill was particularly pernicious. A long twig, say of half an inch, would jam diagonally in the space, and the bearer, holding the stick by the middle, would find herself lifted on to tiptoes so that she could get no purchase, up, down, forward, or back. Here she would wrestle and twist, sometimes with the assistance of fellow workers, until the contrary burden could be juggled around to a manageable position or lifted over by some Sepi clinging precariously to the edge of the sill above. It was not so bad for the leaf bearers. They could climb on over the barrier, balancing their green umbrellas overhead. But leaves were rather scarce with our ant family, for they had harvested the nearer end of the patio pretty thoroughly.

We annoyed the Sepis quite a little, no doubt, by sweeping up the sala and gallery two or three times a week. Good housekeepers may hold up their hands in holy horror at this, but, after all, two

"SHE PREFERS LEAVES"

"Rose bushes, vines, and shrubs must be surrounded by circular pottery gutters sunk in the ground and filled with water so that the insects cannot cross"

lone men living temporarily in such circumstances should be excused for not cleaning house every day, even though they had such careless companions as the Sepis. We never could determine how the ants reacted next evening to the discovery that the previous night's accumulation of supplies had disappeared. This could not have been unusual in the Sepi world, at least among the Santa Cruz dwellers, so they probably took it philosophically.

We must have trampled to death a number of ants, also, walking about in the evenings when we could not see our little neighbors. However, they accepted this with the fatalistic unconcern of New Yorkers who see one of their swarming nest dwellers stricken down in some traffic accident—all in the day's work, each survivor mildly thankful he was one to escape.

The ants must have scouted constantly for new prospects and possibilities of food supply. One day we incautiously allowed the protecting ring around a rose bush in the patio to become dry. The observant Sepis discovered the fact immediately and next morning our poor bush bore but a solitary leaf, the busy workers having stripped it bare of every other one and even gnawed the tips off the smaller branches.

My bedroom was the last in the row from the sala. A door opened from it on to the gallery and patio. On a night as dark as the proverbial sack of black cats, I was awakened by a queer sound near the open door—a steady rattling, snapping, and rustling—not loud but as regular and unceasing as the rush of water over a rapid. For a minute I lay trying to determine what this strange disturbance could be. It was inside the

room and near the door. It sounded not unlike a slow fire in half-dry leaves, yet there was neither light nor odor of smoke. It was not, either, the sound of any creeping or crawling thing, animal or reptile; of that I was sure. My companion in the next room, the wall of which was just beyond the gallery door, snored peacefully. Evidently I was not deceived by some acoustic freak of the building. The sound was not in his room; it was in mine. But what it was I could not imagine.

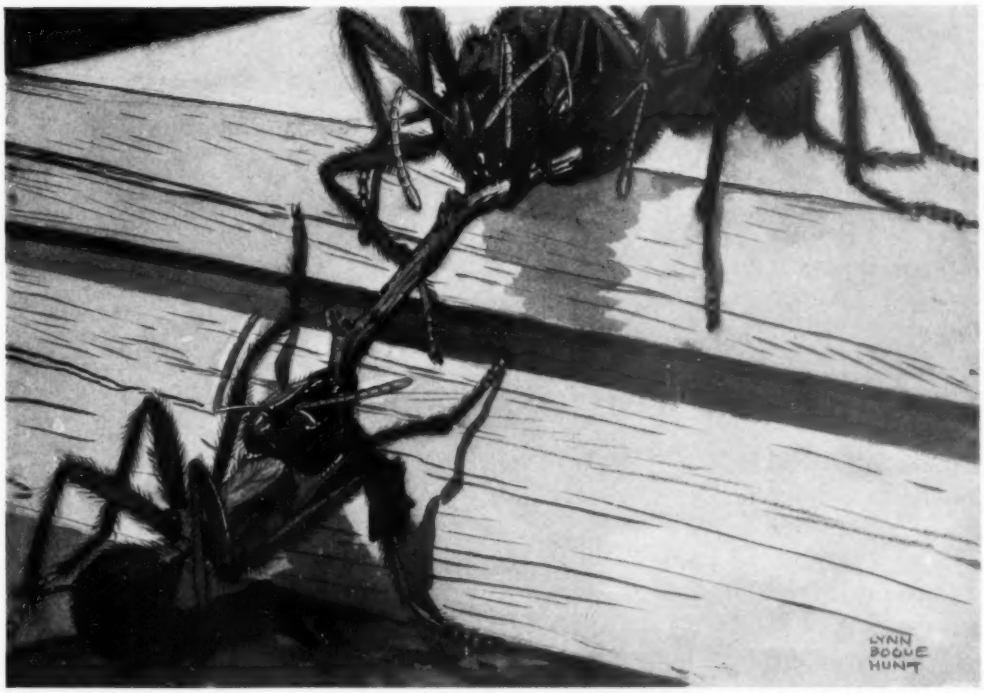
With one hand I drew my six-shooter from where it hung under the head of my bed and with the other I reached for a match from the table beside me and struck a light. Nothing unusual was visible at first, but the sound continued, calmly, steadily as before, from the corner of the room just beyond the door. Here stood our household broom, a bundle of young palm shoots with dry, spiny leaves, stiff and woody. In that was the sound. Then I perceived a dark moving band on the floor, extending to and beyond the doorway. I took another match and hopped out of bed to investigate. The broom swarmed with Sepis engaged in cutting up those bristly spines and hustling home with them. I left them at their work and returned to bed.

It took them two nights of persistent effort to demolish that broom, denuding it to the bare stems. We never were fully decided whether this was simply a foraging enterprise, or if the astute Sepis had discovered in the broom the immediate author of the disappearance of many a night's supplies left along the roadside at daybreak, and were taking this occasion to remove, as they thought, permanently, the very troublesome and destructive nuisance. It seemed strange that they should have taken to such tough material as that broom, when in the back of the patio were so many tenderer and what appeared to us to be much more choice leaves and small bushes. But these may not have been suitable for ant mushroom culture.

In the meantime we had begun unwittingly to sow real Seeds of Disaster about our Sepi city. It was the height of the orange season. For a Bolivian ten-cent piece, worth, say, three cents in United States money, one could purchase seventy big juicy oranges of a fineness and flavor that would have caused a native Californian to drop dead of envy and chagrin. Every morning boys peddled them through the streets in squeaking carts with solid wooden wheels and drawn by yellow and white spotted oxen. It was hard to see how, at the price, they made the expenses of the distribution. Actually, I suppose, there were no expenses. The cars required no gasolene and it was self evident to the ear that they received not even axle grease. The oxen ate oranges. So did everything else in Santa Cruz, even dogs and cats—and Sepis could find use for them.

Every morning before going round the corner to where that good old lady Doña Lucinda served us breakfast, my partner and I ate from twenty to twenty-five oranges apiece. We tossed the peels in a heap at the back of the patio to dry, after which we burned them. The seeds we dropped along the edge of the gallery as we ate. A careless procedure, no doubt.

Soon we noticed the Sepis were taking advantage of this windfall of supplies and were nightly harvesting the seeds of the morning before. We felt we were doing our neighbors a favor and were careful to keep a good supply of seeds on hand for them daily. A new and interesting feature came into their working columns. Through the ranks of leaf- and twig-bearers was a slower moving column of orange seeds, whole companies and battalions of them, glistening like ivory in the candlelight which served to make



"THE DOORSTEP WAS THE CHIEF OBSTACLE"
"Here they struggled to raise their heavy loads over the inch-high, vertical wall of the doorsill'

less visible the dark bearers in the shadows on the dark floor and gave the seeds the appearance of fat, shiny, white bugs moving along in procession.

The seeds made particularly difficult burdens both on account of their size and of their shape. Also, it seemed remarkably hard to hold on to them, perhaps because of their smooth, polished surfaces. A bearer, after much maneuvering around the seed and several tentative graspings, front, back, and sides, would finally take hold and get all arranged to go when suddenly the contrary object would slip from her grasp and spin away or roll over, Sepi and all, perhaps overturning a couple of other loaded ants in so doing, and occasion a whole new start.

Such tugging, pulling, pushing, as those orange seeds required! Then, when they had been moved so far, what indescribable difficulties were experienced at that bugbear of the road, the doorstep! Every morning, when the weary workers had retired within their brick-capped city to rest and prepare their gardens from the woody supplies they had carried in the night before, we would find an embankment of orange seeds at the sala door. All night long a continual struggle went on to hoist the unwieldy objects across the wooden bar. Now and then an ant would get a seed, longer than herself and far bulkier, balanced over her head precisely like a leaf umbrella, and with this great load would calmly ascend the vertical wall, like an automobile on a Pike's Peak trial, and, crossing the top, unconcernedly fall off the other side into the sala, right herself, never losing hold of the seed, and continue to the nest. But such feats of skill were rare. Usually three or four Sepis might be seen struggling with each seed, beneath and above it, the slippery seed escaping them again

and again, rolling off over the patient toilers or dragging them down with it from the sill.

It was a business which might well have tried the patience of saint or Sepi, yet they kept perseveringly at it, buoyed, no doubt, by the thought of the luscious orange-flavored fungus that was in store. Perhaps they even boasted to strange Sepis of other cities of their good fortune, detailed the advantages accruing to the *citoyennes* of the sheltered City of the Sala, and extolled the superiority of their mushrooms, nurtured on orange seeds. Perhaps scouts from some rival city discovered the treasure trove which our Sepis possessed and from which they garnered nightly. Since ant maidens at least retain one old-fashioned maidenly virtue and seldom if ever speak to total strangers, even of their own race, the latter supposition is more probably the correct one.

Whatever the means, the report must have gotten out, and, just as in the human world the wealth and contentment which one nation enjoys invariably arouse the envy and hatred of those others that lack them, so the orange seeds, which our Sepis may well have considered a dispensation from the gods and an indication of special favor from their particular deity, turned instead into the precursors of destruction which war and rapine released upon the happy city.

One day after we had acquired a new broom, I swept clean all the house including the Sepi road and the environs of their city. Next morning the sala and gallery presented a strange appearance. There were neither seeds, twigs, nor leaves to be seen, but everywhere was some fine reddish stuff scattered and heaped all about like a too plentiful sprinkling of cedar sweeping compound. It was thickest about the city gates. Also it was piled high on either side of that fatal doorsill which had caused the Sepis so much hardship. What had the Sepis been collecting that night, we wondered.

On investigation we were horrified to discover the red "sweeping compound" was all a tangled mass of little Sepi bodies thickly heaped in fragments about the floor. All were alike. Sepi had fought with Sepi and here was the fruit of their nocturnal combat. What an awe-inspiring sight must have been that frightful struggle between the hosts of diminutive warriors. Alas, that on that night of all nights something else occupied our time and the battle raging at our very side went unobserved!

However, after a study of the battlefield, one may reconstruct all the catastrophe. Inasmuch as scientists hold that ants of a city never fight among themselves, there must have been some outside enemy which fell upon the industrious workers of the City of the Sala.

Could we, then, have looked into some neighboring Sepi city on that fatal evening, we would have seen the warriors massing in the tunnels and passageways and moving up toward the surface, eager and excited at the prospect of the coming foray. Workers, too, are gathering to join in the raid and help harvest the spoils of victory. For long the dwellers of this city have struggled to find wood scraps and leaves in some barren patio with which to raise their scanty gardens of fungus, and much foraging has left little to supply the needs of an ever-increasing population. They are hungry, living on short rations. But now, their scouts have told them, they will find plenty, even overabundance of food in the rich and favored City of the Sala. Small wonder that the waiting Amazons are eager, combing their feelers nervously, the very taste of orange-flavored mushrooms already in their mouths.

With dusk they sally forth in a great stream, marching swiftly, led by the adventurous scouts who have already

"AN ORANGE SEED MADE A DIFFICULT BURDEN"

"Through the ranks of leaf- and twig-bearers was a slower moving column of orange seeds, whole companies and battalions of them"

spied out the land. Into our patio they go and across it to the brick-floored gallery. Meanwhile, the workers of our city have set out as usual, all unsuspecting of danger, to their nightly harvesting. The branching columns have come down into the patio among the orange seeds and the leaders have already taken up their loads and started back toward the city, when the raiders strike.

Some advance worker of the Sala city catches the signal of danger on her sensitive feelers and sends the note of warning to her companions. But it is too late. A great noiseless telepathic cheer vibrates from the forest of upraised feelers and the Amazons hurl themselves upon the workers all along the gallery edge.

Through the heaps of orange seeds the opening skirmishes are waged. The working girls of our city are no cowards. Attacked, they unhesitatingly turn to give battle, pitting their little cutting jaws against the mighty crushing ones of the soldiers. In the patio and along the gallery they stand little chance. The scattered lines are quickly overwhelmed by the masses of the enemy. But the survivors retreat steadily toward the city, their number constantly increasing until they make a decided stand at the doorsill.

Here the battle rages furiously. Though the workers lose ten to one, many an invading warrior is dismembered, her legs and finally her great head hurled upon the field by the desperate and determined working girls of the Sala, even though those warrior jaws work fearful havoc with the smaller opponents ere they are torn from body and limb.

Gradually the invaders gain and hold a footing on the disputed doorsill. The workers are driven back and all the sala

between the door and the city gates becomes a battlefield, a swirling maelstrom of tossing bodies, writhing legs, and slashing jaws of the frenzied combatants, of little groups of workers fiercely cutting a soldier invader to pieces, of Amazons charging back and forth, perhaps dragging an enemy or two on their legs, slashing and crushing with their mighty jaws. Nor is the battle noiseless. There are quite perceptible sounds of combat. A scratching and shuffling by that myriad of tiny feet pounding upon the bricks of the sala. A faint cracking and crunching as jaws grind through skulls and horny chest armor of smitten fighters. Even, I can believe, there rose a tiny dust cloud from the field where these miniature Greeks and Trojans contended for a city and its wealth.

Surely the question in every worker's mind as the battle raged must have been, "Where are our own soldiers? Why don't they come to our aid?" Truly, where were they? Why indeed did they not sally forth to aid their hard beset worker sisters? Were they so besotted and enervated by gorging on delicious orange mushrooms that strength and courage had left them? Were those beds of orange-seeded fungus a fatal formic counterpart of the Capuan baths that enervated Hannibal's all-conquering Carthaginians? Certainly, all the battlefield proofs indicated that not one warrior issued from the portals of the Sala city to fight for home and country, not even when the surviving working girls rallied about the city gates and died there practically to the last woman. Over all that heaped field of dead, where worker clung to warrior and warrior to worker, there was no sign that even so much as one warrior had come forth and laid jaw to enemy soldier.

Next day the underground city held secret from us what may have occurred when the conquering invaders poured into its depths. Within they must have "put to the jaw" every living inhabitant they came across. Queen, drones, courageous worker and cowering warrior doubtless suffered an equal fate. Then, the battle won, the city theirs, the invaders must have gathered mushroom gardens, orange fertilizer, and whatever else they considered of value, and returned in long triumphant column to their own nest.

When dawn broke palely across the shadowed patio and sala, the field was again quiet after the storm of battle and plundering, and all but deserted by the living. Only the ghastly "sweeping compound" of heaped bodies remained, worker and warrior locked in the embrace of death. Legs, hands, and dismembered torsos were everywhere. Scattered among them were a few wounded, pitifully struggling, less fortunate than those who had already died. A worker, half her legs gone, a warrior's head clinging to one of the remaining members, feebly tried to right herself and crawl away. A soldier, dreadfully battered, writhed in futile striving to escape the grasp of workers whose jaws were forever closed by death. Another dusty, bedraggled soldier, her abdomen nipped off, crept miserably about waiting to die. Others, warrior and worker alike, lay there, mangled in every imaginable way. In this the workers had a grim advantage. Though their dead far outnumbered those of the invader warriors, their wounded were fewer. Jaws built for fighting did their work better than those prepared by nature for the peaceful occupation of plant cutting. Altogether, the wounded of both sides were few. No quarter could have been asked nor offered in this battle between cousins.

A few warriors were going over the field when we came to investigate. These must have been survivors of the Sala tribe now tardily on the surface. They,

THE BATTLE IN THE SALA

"The workers are driven back and all the sala between the door and the city gates becomes a battle-field, a swirling maelstrom of tossing bodies, writhing legs, and slashing jaws"

however, seemed to pay not the slightest attention to the dead or wounded. Also one or two workers were wandering about in a dazed sort of way, still dust covered as evidence that they had done their share of fighting on that awful night. They walked past the military patrols without being noticed nor did they pay any attention to the soldiers. They moved slowly with a manner of utter weariness and despair. About the gates of the city stood several more soldiers, quiet and dispirited. The future for these survivors of the catastrophe must have been quite hopeless. They had been robbed of everything to the last vestige of their mushroom store, so that starvation confronted them. Undoubtedly their queen had been slain in the general massacre, and with her had perished the head and the vital force of the tribe, the very city itself. Nothing remained then for the miserable little group of survivors but to perish also.

We left things as they were for twenty-four hours to see if additional survivors might appear from below ground, and if they would make any disposal of the dead, but in the evening no bustling workers sallied forth as had been their wont, and next day found the field still heaped with slain. Only a few despondent military patrols appeared at the portals between the bricks. We swept up the battlefield that morning. An occasional soldier came from below ground that day, and the succeeding night a half-dozen workers appeared and crawled aimlessly about. Then they also disappeared. Whether the handful of survivors migrated from the ill-fated city to attempt to found another on what they had preserved from the disaster, or whether they had merely retired to the depths to slowly die, we could not tell, but during the month of our stay in Santa Cruz after this catastrophe, the Sepi city of the Sala remained as dead as Pompeii.

ACROBATS OF THE MONKEY WORLD

The Antics and Marvelous Vitality of a Troop of Captive African Monkeys

By W. HENRY SHEAK
Naturalist and Lecturer

RECENTLY I had the good fortune to have under my care for about two months a collection of nearly fifty mangabey monkeys, one of which was of the white-crowned species, *Cercobus bunulatus*. She was one of the most delightful pets I have ever had, as gentle as a kitten and as affectionate as a human child. She seemed to take delight in my presence. Much of the time we had her tethered to a cage of mona monkeys, and the top of this was her headquarters. Whenever I came within reach, she would climb on my shoulder; when I stopped to feed the monas, she would come and sit on my knee, or snuggle up into my arms, making it difficult for me to go on with my work. A favorite approach was to creep under my arm. She was a shameless beggar, always teasing for something to eat whenever I was preparing feed. She would "talk" to me by the hour in a low crooning voice when we were alone together in the room. My clothing was a source of great curiosity to her, and she never grew tired of minutely inspecting my various garments, looking over them as one monkey looks over another.

All the other monkeys in this collection were sooty mangabeys, *Cercocebus fuliginosus*. This is a large species, dark slaty-blue in color, and with the singular habit of carrying the tail always thrown forward over the back when standing or walking, as is well illustrated in the photograph showing the monkey perched on my shoulders.

The sooty mangabey is an acrobat *par excellence*. He is good-natured and friendly, especially when taken young. He is the one monkey in the great African rain forest that will not bite when first caught. Of course there are exceptions to the rule; some of the old males become surly and will attack. But no monkey makes such an ideal pet as the mangabey, not even one of the capuchins of South America. Always active and playful, he is a model monkey for exhibition.

I had thirty-six of my sooty mangabeys loose in an upstairs room. Instead of being afraid of me and crowding into a far corner when they heard me coming, as did the green monkeys in an adjoining room, they would gather about the door, eager to see what I was bringing them to eat, and ready to pounce upon the buckets the instant I set them down. One specimen, who was unusually tame and friendly, would jump and grab hold of the rim of the bucket, when it was still in my hand, and climb inside of it. Often I would sit over the bucket and hand out the bread or vegetables to them. Each would come and take his share out of my hand. Sometimes, with both hands full, a monkey would walk away on his hind feet in an upright posture. But more often, with a potato or other vegetable in each hand, he would walk across the floor, placing the potato in his right hand on the floor at each step, while he carried his left hand with its potato well away from the floor.

Often when I was thus seated over the bucket, the pet I mentioned in the last paragraph would come and crowd in between my legs and help himself to any choice bit the vessel might contain. He frequently sat on my knee while eating, sometimes even on my shoulder. He got to be a trouble maker. He would

Photograph by N. H. Hartman

SHELLED CORN FOR DINNER

Nibs, the mischievous member of Mr. Sheak's troop of sooty mangabey monkeys, often would perch on his master's knee while feeding

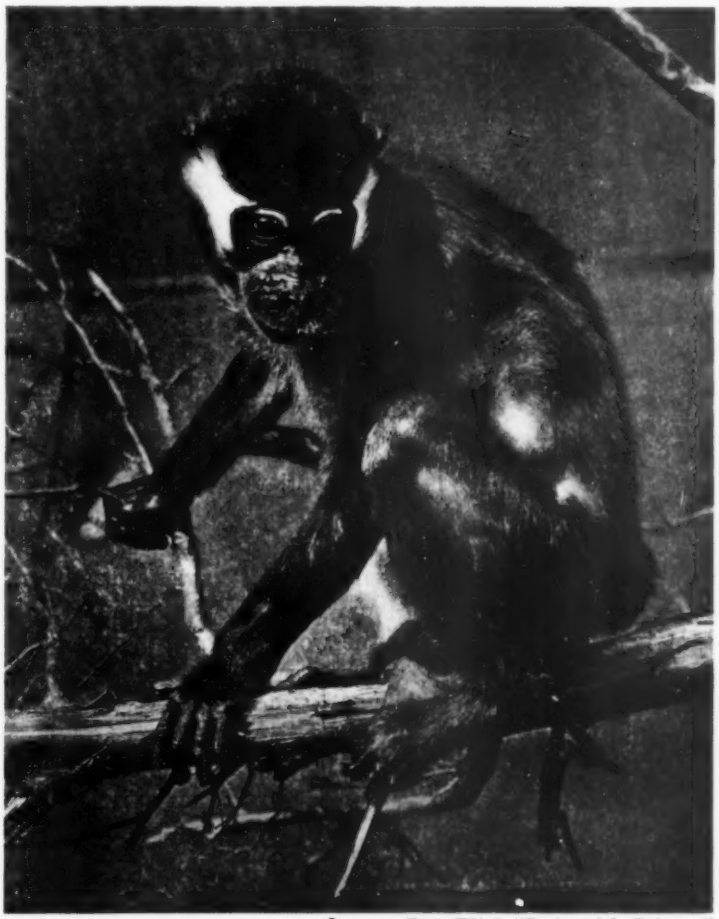
start a row with one of the other mangabeys by snatching his feed or biting his hand or foot, then run and jump into my lap where he was safe from pursuit. One afternoon I was stretching a rope across one corner of the room, as a perch or swing, making one end of it fast to a board nailed across the window. Nibs started the usual fight, ran and jumped into the window, and snuggled in between me and the glass. Like all bullies he was a coward, and while he did not hesitate to attack any of his fellows as long as I was in the room, he always ran to me for protection. Even when two other monkeys got into a squabble in a far corner, he would run and jump into my lap with a scream of fear.

Another mangabey had been a pet in a family where there was a small boy and two older girls. If the monkey whimpered, one or another would hurry to him, pick him up, and get him something to eat. So whenever he caught sight of me he began an incessant chatter, and kept it up, until I satisfied his wants. I always had to attend to him first—before I did anything for the others. One Sunday morning he was tied outside on a window ledge. I was sweeping away some straw that one of the chimpanzees had thrown off the roof, when I happened to come near this mangabey. He caught me by the hair and began to look over my head. Deliberately and carefully he worked, all the time holding me by the left ear with one foot, the great toe and other toes being just like thumb and fingers. When he was through with one side, he would give me a yank by the hair and pull me

around to where he wanted me. There were no "cooties," but every now and then he found something which went into his mouth and seemed to be to his liking.

Among the sooty mangabeys was an unusually fine large specimen which we called Max. Max was the most active monkey I ever saw. He was snatching and grabbing at things from morning till night. He was never still a minute. At first we had him in a small cage surrounded by other similar cages. I had great trouble in feeding and watering the other monkeys, because Max was always snatching what I wanted to give them. Before I could get a piece of bread into an adjoining cage, he would have it. When I attempted to put a pan of water into the cage above his, he would snatch it and spill the water. If I succeeded in getting the pan into the next cage, the chances were about two to one that with his long arms he would be able to reach it and upset it. Even his own food he seemed to enjoy more when he could snatch it out of my hand, than if he let me put it in the cage. One day, after I had divided my own lunch with him, he snatched out of my hand a paper bag containing a big piece of bologna, which he proceeded to eat. At this I was surprised, for, aside from the baboons which are largely insectivorous in their diet, none of the monkeys are carnivorous to any appreciable extent. Then, too, bologna is a highly artificial product. Later I offered some of it to both the Guinea and Galada baboons, but they refused it.

This mischievous mangabey was strongly tempted by the rubber band I wore about my shirt sleeve. His eyes were very keen and he never failed to see it, no matter how thread-like it was. He



From Elliot's "Review of the Primates"

THE WHITE-COLLARED MANGABEY

This monkey (*Cercocebus torquatus*) of west Africa lives in the forests of southern Nigeria, Cameroon, and Gaboon. It has rather a shrill call, and frequently descends to the ground to feed

almost always got it, too. One morning he was chained on top of a large box-cage. I was cleaning a smaller cage near it, and had to get down on one knee to use the scraper. Max climbed on to my back, got astride my neck, with his long legs hanging down nearly to the floor, and tried to untie a handkerchief I had about my throat. Another time, when I was standing, he climbed up and got astride my neck. He had a very exalted opinion of his own importance. He seemed to entertain the conviction that, instead of being subject to me, he was the master and I the slave—that I existed for the sole and only purpose of serving him.

One of Max's favorite performances was to rub his face with his feet or hind hands, just as a laboring man rubs his face with his hands in washing after a day of dirty work. He always used both feet, going over his entire face, carefully and thoroughly. It was an interesting piece of acrobatic work, and bordered on the realm of the contortionist.

A certain hot morning in August I was watering my charges before cleaning the cages or feeding. Max was still in his big box-cage. Bad as he was inside, he was much worse on the outside because he would climb all over me and appropriate anything that struck his fancy. So I did not want to take him out till I had cleaned the cage. There was no opening at the bottom of the cage and I had no pan that would go between the wooden bars. If I opened the panel that served as a door, he would push his hands, if not his head, through the portal, and I would have difficulty in closing it. So I got a drinking glass full of water and held it out to him. This was a puzzle. He did not know what to make of it. I showed him it was water by letting the fluid trickle over the side. He was thirsty and drank two or three swallows. But his curiosity was stronger than his desire for drink. He got back, looked at the glass from one side, then from the other. He put his hand against the glass and felt of it. He never before had seen a drinking vessel through which he could see the water. After examining the glass with his fingers, he put his hand down into the liquid. He looked at it again from various angles, after which he took a few more sips. Once again he studied the glass from different sides and felt all over it and inside of it. By this time he had lowered the water almost half way. Finally he tried to drink through the side of the glass on a level with the water surface.

One evening Max had gone around a post of the balustrade inclosing the flat roof of the porch, and wound his chain about it till he could not quite reach the pan of water I had placed on top of his big box-cage. Seeing he was in a dilemma, I did not move the pan nearer, wondering how he would solve the problem. He did not make any frantic efforts to reach the pan, as I expected he would. Neither did he hesitate a minute, but went back to the post, followed the chain once around, then came and drank the water. The species is marvelously intelligent and quick in grasping a thought.

* * *

The African green monkeys and their allies (*Cercopithecus*) might well be characterized as activity personified. They so abound in vitality that when confined to a cage they are like a boiler under high pressure of steam. I have seen the green monkey take a position on the floor of his cage, or on a broad, flat perch, jump several inches into the air, come down on his hands, rebound, alight on his feet, spring again into the air, strike once more on his hands, and keep up this springing, rocking motion for fifteen or twenty minutes with the regularity and precision of the swing of a pendulum. His muscles act like elastic steel springs.

The vervet has a similar method of

relieving his pent-up energy. Without touching his hands to the floor, he will jump with his hind legs, well into the air, and repeat, time and again, with increasing rapidity, until the on-looker becomes fairly dizzy. The secret seems to be that in the native free state they live lives of such intense activity, that when brought into confinement they are compelled to invent some method of exercising their muscles and working off excess vitality. They are all primates of slender, graceful build, with attenuated limbs and bodies, as well as long tails, adapted to seeking their food in the tops of tall trees. They must be alert of mind, stealthy and quick of movement, to escape their numerous enemies, such as the leopard and the serval.

The mangabeys are a detached offshoot from this group. Buffon so named them, after a locality in Madagascar, under the delusion that they came from that great island, the central home of the lemurs. They are not only not found in Madagascar, but are confined largely to western Africa, and do not range very far to the south. They are given a genus to themselves, called *Cercocebus*, and there are five or more species. They are distinguished by peculiarities of the teeth; by the backward direction of the hairs of the crown, which can be observed plainly in the large illustration accompanying this article; by having the face more lengthened, the whiskers small, the eyebrows very prominent, the eyelids an ashy-white, and the size somewhat greater than in the typical *Cercopithecus* monkeys. They are often called "white-eyelid monkeys."

But like the typical members of the group, they are slender of form, have long limbs and tail, and are extremely agile. The general color is dark or blackish. The black mangabey is the *Cercocebus aterrimus* of the zoölogists. He may be known by his very dark slaty color, deepening to black in some places. The collared mangabey (*C. torquatus*) has a well marked ashy-gray band or collar about the throat and nape; also the cheeks and chest are white. The white-cheeked mangabey is *C. albigena*, in which the forehead is also white or ashy-gray, and the underparts whitish.

I have said that one of the distinguishing features of the mangabeys is the backwardly directed hair on the top of the head. But the white-crowned mangabey (*C. lunulatus*) is an exception. The hairs on top of the head are not only of a light ashy-slate color, but are longer, erect, though somewhat compressed or flattened, forming a distinct crown, not unlike that of the bonnet macaque, an Asiatic species. The hair of the entire animal is more soft and furlike than in the other species, and is slightly tinged over the body with a soft slaty-brown. At least two other species (*C. albigena* and *C. aterrimus*) are also provided with crests.

MAX, THE BIG SOOTY MANGABEY MONKEY, STANDING ON MR. SHEAK'S SHOULDERS

"GEOLOGY POINT" BEAR MOUNTAIN

TRAILING NATURE

How Nature Trails Are Operated at Bear Mountain, New York, by the American Museum in Coöperation with the Commissioners of the Palisades Interstate Park

By WILLIAM H. CARR
Assistant Curator, Dept. of Education, American Museum

A HOARSE, prolonged whistle echoes up and down the narrow, rock-lined Hudson gorge. It is eleven o'clock in the morning and the first crowded Dayline boat is groaning to a protesting stop alongside the Bear Mountain dock. Before the day is over, many more boats will pause here long enough for some 40,000 persons to walk ashore in the hot summer sun. These people, of many nationalities, have come forty miles up the river from New York City to enjoy a breathing spell in the open air.

Like veritable sheep, they struggle up the steep, narrow path that leads from the river level to the cliff top, above. Here they come, a steady stream of perspiring, tired humanity, taking advantage of what, to them, must be an out-of-door Utopia—the beautiful Harriman section of the Interstate Park! The head of the line reaches the upper level and pauses to look upon the rounded, quiet mountains. Just ahead is the covered ramp that leads over the bear dens to the Inn grounds.

It is when they have nearly reached the bear pit, that some of the crowd may notice a modest little sign announcing:

THE BEAR MOUNTAIN NATURE TRAILS
AND TRAILSIDE MUSEUM
THIS WAY

"Elsie," the disdainful black bear of Bear Mountain, is perched high up in the branches of an oak tree, sound alseep. Her black muzzle rests on the tree trunk, and she pays not the slighest attention to what is going on about her. Though "Elsie" is not interested in the people, we are. It is for them that we have labored for the past two years. Many persons who are "nature minded" and many who are not, now leave the throngs, and we know that presently they will pass our first sign and stop before the "Nature Trail Bulletin Board," beyond. A keen-eyed young man, his wife, and his little boy, have stopped a moment to catch their breath after the long climb.

"Nature Trails," reads the man, vaguely,—"What are they? Where is

the 'Trailside Museum,' anyway? I don't see it!"

The bulletin board is there to answer him. Nevertheless, we hear his query and walk over to explain. There is nothing that can equal a direct, personal contact, and we always like to make as many of them as possible.

"The Nature Trails," we tell the man, "are operated here by the American Museum of Natural History in coöperation with the Commissioners of the Palisade Interstate Park." We then indicate the first introductory label, which reads:

SIGNS ALONG THE TRAIL

How many of us are able to read, unaided, the 'signs' of Nature? Let the guiding labels take the place of a naturalist friend who has an interesting story to tell you as you follow the trail

"I see," says the father; "We go along and read a lot of labels that tell about things—about trees and rocks. Is that it?"

"You are right," we answer. "The labels are spaced about twenty feet apart and they tell you much more than just the names. The best way is for you to follow the trail and read about the things that interest you."

"How about snakes," asks the man, as though he were in a department store. "Have you any? Junior wants to see a rattlesnake."

"We have no rattlesnakes just at present," we answer; "but there is likely to be one along any day. How would a copperhead do? We have a mother and four babies with grass-green tips on their tails!"

Junior is immediately anxious to see the babies with green tails. He forgets all about rattlesnakes in his enthusiasm.

A sizable crowd now finds the trails and pushes on past us. Nature Trails require no guides; nevertheless, we think it worth while to accompany the little family on their way to the Trailside Museum. Junior and his father are primarily interested in the copperheads, yet they pause frequently to read labels as they go along. The woman finds one on the chestnut oak.

AT THE BEGINNING OF THE TRAIL

An attractive bulletin board tells the interested visitor "What to look for this week"

"TOAD HOUSE"

A home for transient toad residents is built in a tree at the side of the trail and constructed so that visitors may become better acquainted with its occupants

"Is there a tree here that is just a plain chestnut?" she asks.

Her question is answered automatically, for she comes upon another sign on a small oak tree that says,

> THE CHESTNUT OAK LEAF, THOUGH DIFFERING SOMEWHAT FROM THE SHAPES OF THE AMERICAN CHESTNUT LEAF, RESEMBLE IT. THUS THE NAME 'CHESTNUT OAK'

Underneath this label is another with a drawing of both leaf types. The legend here advises that,

> THERE ARE SOME TRUE AMERICAN CHESTNUT SPROUTS NEAR THE SWAMP TRAIL. LOOK FOR THEM

We soon pass the granite ridge and have nearly reached the Museum. The three visitors have read perhaps thirty labels and have missed as many more. Junior discovers a bird's nest in the midst of a clump of high-bush blueberries.

"What's this, Daddy?" he shouts.

Daddy pauses and looks. It is simple enough for him to answer; for just in front of the deserted nest is a small sign upon which is mounted a colored drawing of the bird that made the nest. The caption reads, "This is a last year's catbird's nest." The nest is wired to the branches so that it cannot be dislodged. However, the wires are concealed and do not spoil the picture.

'What is a catbird, Daddy?"

"I don't know," says Daddy; "look at the picture."

"I see," says Junior; "but why do they say 'catbird'?"

"Probably because cats like to eat it," cheerfully returns father, with a happy burst of inspiration.

"You're wrong!" announces his wife, who has discovered another label. "This sign says that it is named a 'catbird' because one of its calls sounds like a cat mewing."

"Fair enough," says father.

Presently we arrive at the Trailside Museum, the focus point from which all of the trails radiate. It is constructed of

worn glacial bowlders, retrieved from a near-by hillside. It looks as though it had always been there.

"What a lovely place!" the wife exclaims. "Let's go in!"

Once inside, Junior, forgetful for the moment of his snake quest, locates two microscopes on a green-topped table in front of a window.

"Daddy, come here!" he cries. "What are these things?"

Daddy is engrossed with a miniature model of a beaver pond, and is reading a label that tells him to "see the live beaver in the pond below the bear dens" before he goes home. Thus Mother walks over to the table to aid that eternal little question mark, her son. Here, once more, she finds labels that tell a story. One of them reads:

> THESE MICROSCOPES ARE FOR YOUR USE. YOU ARE INVITED TO GO WITH THIS LITTLE ENAMEL PAIL TO THE POND, JUST OUTSIDE, DIP THE PAIL FULL OF WATER, RETURN HERE, AND, WITH THE AID OF THIS MEDICINE DROPPER, EXAMINE YOUR FIND BENEATH THE MICROSCOPE

Following his mother's instructions, Junior takes the much used little pail and is soon back with nearly as much water on his clothes as is in the pail!

Mother extracts a dropper full of water from the pail, places it on a glass slide beneath the lenses, and in a moment, she, too, is calling for father. She has seen something that she never saw before. Responding to her call, father comes and is soon looking excitedly at the antics of a tiny "water flea" that through the microscope looks large indeed!

In the meantime, the restless Junior is pleading for a "look." However, he has to wait until his parent has identified the "flea" by means of the photographic chart that is near by.

At last Junior gets his chance, and while he is squinting at the now discouraged little "flea," father looks on and says: "I should think you would be afraid to let people use these instruments. It's a wonder they aren't broken!"

We explain that although many hundreds of persons have used them, not once have they been injured!

"Why do you call this place a Museum?" queries the man. "There are no stuffed birds or animals, here!"

"This is no place for mounted animals," we answer. "There is no room, and if there were, we would not use them, for this is an out-of-door museum. It is a museum without specimens. All you will see here are models, instruments, charts, and living things. That is the object of

A WINDMILL LABEL

The geology of Bear Mountain is not overlooked by the Trailside Museum. The label under observation in this picture tells about the glacier that once covered the district

this Trailside Museum."

"Good idea," volunteers the father. "Something different always pays. There are plenty of museums in the city where they have stuffed things with glass eyes."

An hour soon passes, and still the "sights" in the small building have not been exhausted. Junior finds a hog-nosed snake in a glass cage. He reads the sign which says,

AN OPOSSUM OF THE REPTILE WORLD

We take the snake out and demonstrate its "possum playing" capabilities. Junior, despite his mother's pleas to the contrary, picks the hog-nose up and handles it, curiously studying its actions. As soon as his mother observes that there is no harm done and that the reptile is as harmless as we have pronounced, she plucks up courage to touch first, and then to hold it very gingerly, while her husband admiringly looks on.

Junior is now reminded of the copperheads. We lead him to the green-tailed babies and tell how they were discovered in a boys camp museum not far away. Many are the snake myths that we explode in answer to the father's questions. Of all maligned creatures, snakes are no doubt in the front ranks. The ways in which they are misrepresented are without number.

Outside, upon the trail once more, we pass the self-explanatory geology stone wall, where labeled rock specimens tell of the story beneath our feet. We reach "Geology Point ' overlooking the Hudson and stop for a moment to look through the trees to the scenes beyond. Across the river, "Anthony's Nose" rises against the blue sky line, a huge rounded dome of tree-covered rock. Bear Mountain Bridge appears and casts its graceful black shadow on the motionless water far beneath. Two crows down by the river edge "caw" nervously as a train approaches through the tunnel near by and comes roaring out to fly down the glistening steel rails seventy-five feet below us.

ALONG THE TRAIL

Labels, which are spaced about twenty feet apart, give much information besides the names of objects. Arrows on this revolving table indicate many interesting scenic features about "Geology Point"

Junior, in the meantime, has done some exploring on his own account. He rushes up and exlaims: 'Daddy, come with me! I found some skunks!"

Back we go to the cages near the turtle pond where two little black and white

THE AMPHIBIAN TABLE IN THE TRAILSIDE MUSEUM
Salamanders, tadpoles, and young toads tell their own life stories with the aid of Museum labels

animals have attracted a good-sized crowd that stands looking at them with mixed emotions. We walk around to the back of the cage and take out one of the skunks, so that Junior may stroke its fur and see it at close range. When we walk toward the people, we notice that most of them fail to hold their ground. They retreat to a respectful distance.

"This is a tame skunk," we tell them. "His name is 'Sachet.'"

The crowd, however, is not reassured. The spectators make no advances until finally Junior takes "Sachet" in his arms and smooths the sleek fur gently with one hand. Then the questions come thick and fast.

"Why doesn't he *do* something?" asks one boy.

"Because he doesn't want to," suggests another.

Eventually, many hands come haltingly out to touch the harmless "Sachet," who, though in full possession of all his weapons, refrains from using them due to the fact that he is not in the slightest alarmed. Like his brothers in the wild, he never becomes offensive unless actually injured or very much frightened.

Before the little exhibition is over, the skunk has gained new friends. We put him back with his sister and watch him curl up and go to sleep. Perhaps there is no other small animal in the world more independent than the skunk unless it be the porcupine! This independence stands "Sachet" in good stead upon the Nature Trails, for he is never annoyed when visitors refuse to take a serious interest in him. He regards all comers with an equal indifference.

"I should think," says Junior's father reflectively, as we walk on toward the snake cages, "it would be quite an undertaking to run a nature trail like this one."

"Well," we return, "it is a good bit of work, but like many another educational projects, the result is more than worth the effort."

"The building of a nature trail," we continue, "is something like the building of a fire. The more carefully the kindling

is laid, the more readily will the wood above burn when once the match has been struck. In the instance of the nature trail, Nature herself has provided the kindling in the way of innumerable out-of-door exhibits. It remains for the trail builder to use that kindling in such a way that he for whom the work has been done may apply the match of interest and see the flame of knowledge."

"There probably is never a lack of fuel!" says the man, understandingly.

"No, there never is," we agree. "That is the least of our worries, yet we must constantly remember that it is impossible to tag and label trees, flowers, and rocks in the open as one would in a museum. We try to make invitations of the signs along the trail. They aim toward the informal teaching of facts as well as of ideas."

At this point in our conversation, we are interrupted by Junior who has deserted us again. He hurries his father on to see "Josephine, the Second," a dignified, great-horned owl, who perches importantly in her cage.

"Daddy, this sign says that owls *do* see in the daytime! Did you know that?"

Before father can answer, there comes from the docks a loud interrupting whistle It is a warning that leaving time has come.

The family misses seeing the hidden label trail, the well without water, the historical trail, "Virginia," the red fox, the elk and the deer, and numerous other things. The whistle calls them again, and with a "good-bye," a "thank you," and a promise to "come again," they walk off toward the waiting boat. Junior calls, as he goes down the hill, "I'm coming back as soon as you get a rattlesnake!"

Tree shadows are lengthening on the open field as we go on up the trail toward the cabin. We pause for a moment beside the active ant hill with its descriptive signs and its protective fence. An elderly gentleman is here regarding the signs. He turns toward us with an expression of real appreciation in his eyes, associates us somehow with the work, and says, "I think this is great! I have been all over these trails and I want to thank you people for giving me an interesting day!"

Drawn by Marion Dergner Carr

Maple sugar.—From the bark the squirrels get their vitamines and a little maple sugar, much diluted

THE RED SQUIRREL FARM

A Palatial Sanctuary for Squirrels that Is the Most Unique in the World

By ROBERT T. HATT
Assistant Curator, Mammals of the World, American Museum

HALF hidden among the peaceful rolling hills of Westchester County, New York, lies a farm that is unique not only in the County but in the world. Here in a large and rambling house its owner has assembled a collection of all things squirrel that has doubtless never been equaled for any other group of animals. One first sees evidence of this when one turns into the estate from the highway and passes between two stone pillars that bear at their top a frieze of painted red squirrels, which mutely let the visitor know that this is the Red Squirrel Farm.

One drives along a wooded lane until the trees recede. Down an apple-bordered drive appears the great house whose mission is evident at first glance. The two upper stories are masked by a great maze of outdoor cages and the forest of branches within them. One at first sees little room for human habitation and, in fact, it seems more likely that the squirrels share their home with Dr. Lillian Delger Powers and her husband than that they have given over much of their home to the squirrels.

To understand this house one must know those who have built their lives into it. It is difficult to dissociate Doctor Powers from her squirrels, yet she is as versatile as she has been thorough, and she may claim distinction not only in her scientific study of squirrels but in her profession as a psycho-analyst. Twenty-four years ago, traveling in Ceylon with her husband, she first became interested in squirrels. One day, while they were driving along a dusty road, a small half-clad native boy held up to them a young palm squirrel in expectation of receiving a copper for exhibiting his captive. Through sympathy for the squirrel they gave the boy a sum of money sufficient to give them title to the creature, which they took back to their hotel. The nights in Kandy were chilly and the baby squirrel was doubtless undernourished. As a result, in the morning the young one was cold and still. Though they had at first taken little interest in the captive, their neglect made them remorseful. Fortunate it was for the little squirrel that both were skilled doctors. They worked over the

inert body as though a human life were at stake, and eventually, with the aid of hot-water bags and massage, the tide of life came back, the little one opened its eyes and won their hearts.

Afterward they settled down near a German seaport. In Germany, squirrels are considered great pets and here Doctor Powers started her collection. Sailors soon learned of her interest and brought squirrels from all over the world to her, and as the collection grew so did her interest. Noted artists were commissioned to make portraits of her squirrels. Some worked in oils, some in bronze, and some in wood. Drawings and photographs supplemented the collection. Some of the pictures shown on these pages were made then. Old sculptured squirrels, tapestry, paintings, stained glass, silver, porcelain, any art work showing squirrels was added. And the artisans about the country were not slow to turn their hands to the task of making objects showing squirrels, which they knew would find a ready market.

Later Doctor Powers moved to New York, where she lived for several months, and then, in search of more suitable surroundings, moved to her present paradise of squirrels. Because the American reds and the German reds were at that time more numerous than all the other species, the farm took its name from the party in the majority.

The guest sympathetic with animals is welcomed warmly. When you first enter the house, you may well be bewildered, for the walls are literally covered with squirrel canvasses. Windows contain stained glass squirrel panels. Sculptured squirrels are legion. Then, from the floor above, you hear strange sounds descending. Two squirrels are running exercising wheels and another is scolding vociferously. In a moment you ascend the stairs to the labyrinth of screen walls that divide the immaculate

COMRADES
Two gray squirrels rest between "shots" in the making of a film

RED SQUIRREL FARM
With 150 squirrels inside and perhaps 50 more outside, the hub of the squirrel world might well be here

linoleum floors into large compartments or, more appropriately, apartments. You put in your pocket, from the ever ready tray, a handful of cracked pecans and pine nuts to show your good will to those squirrels you are to meet. Then you follow into one of the compartments and close the door carefully behind you. Several squirrels come near and look down at you from the interlacing branches above. They run over the screen walls near your shoulder. If you whistle to them or move toward them suddenly, you are not likely to make friends with many. If you move slowly, talk quietly, and call them with a low "*tchu-u-k, tchu-uk,*" you may soon find one on your shoulder looking for the expected nut and showing a delightful confidence. Not all are so confident or friendly, however. Some squirrels come quickly to any visitor, some trust only Doctor Powers and their keeper. One squirrel is so aggressive that even his keeper must lock him in his nest box each time he wishes to clean the cage, for an angered squirrel's bite is not a pleasant thing.

Not all squirrels get along well together and those of bad reputation are isolated. It is sometimes possible to find three species of tree squirrels, a cockatoo, and some flying squirrels all living together in peace. There are fights from time to time in almost every cage, but no more than there might be among the members of one family. Each one knows his own bed and goes to it at about the same time every night to sleep.

When a squirrel first arrives, it is isolated for a time until it gets used to its surroundings and its neighbors. Then it may be put in with a few other squirrels. They get acquainted with one another in a short time (not always without a fight to force recognition of

A PAIR OF NUTCRACKERS

Nuts on the farm are not opened for the squirrels. If they did not have hard-shelled nuts to gnaw through, their teeth would soon grow so long that they would be beyond use and their owner would starve, a martyr to the efficiency of his own chisels

mastery) and then may be moved again. A few squirrels that are favorites are moved every day to keep alive their interest. Though each large compartment has a passage leading to an outside screened balcony where the squirrels enjoy the rain, the snow, and the sunshine, they like a change of scenery, as do humans. Eighteen years is a long time to spend in one abode, no matter how large and fine. A privileged few have crossed the ocean several times with Doctor Powers, but most of them, of course, must stay at home when she is forced to be away. Young ones born within the house must early be taken from their mother or they become too wild. Trust, it seems, is in part born of dependence on food.

As one always finds with pets, every animal is possessed of an individualism all its own that anthropomorphically we call personality. Thus the collection is one not merely of squirrels of many hues and sizes but one of so many different friends, not one of whom reacts the same as does another.

Every squirrel bears a name. I suspect, though, that Doctor Powers has often been troubled to find a new one, with an average stock of one hundred and fifty individuals. There is Gunga Din, the friendly giant of the house, who traveled all the way from Malabar, and his compatriot, Cleo, a charmer with most engaging manners. One offers Gunga Din a half banana and he hangs by his toes and eats it at his leisure.

In the pocket of an old coat hanging behind a door you see something move. Gently introduce your hand and lift out Ultimo. Ultimo was born very late one season to a proud mother flying squirrel. But Ultimo was such a tiny runt that there was little hope of his surviving. Tender care and special feeding pulled

him through and now he is as fine a little fellow as ever glided across a room in this house of wonders. His fur is like thistledown for softness, his eyes like great ebony hazlenuts, and his tail like a feather.

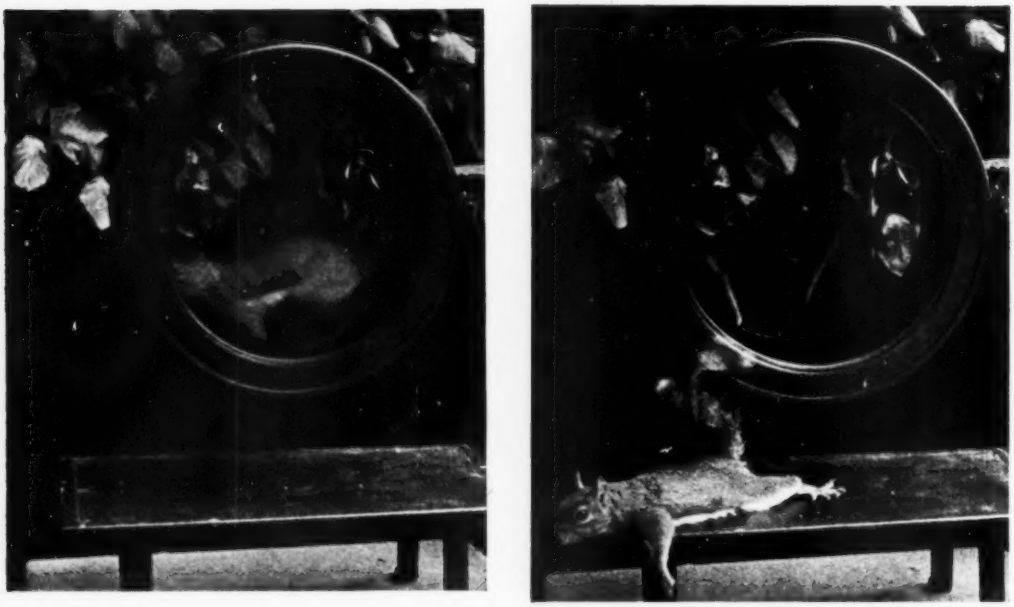
Curly, the most human of any, is of good gray American stock and shows great devotion to Doctor Powers. Every day they play together and Curly's favorite gesture is a gentle kiss with his sharp teeth which he will never use to hurt one. Topsy Turvy over there is running her wheel like a conscientious lady doing her daily dozen. Sampson and Delilah were a faithful couple, and when Delilah died one night of fright after a subway ride in my coat pocket, her husband was grief stricken and called loudly night and day until he got back home. Then there are Tinker-Bell, Carola, Gabriello, Ariel, Puck, and Mustard.

Tico, a Prevost squirrel, takes first place in brilliant coloration. His back and tail are sable black; his cheeks and chin are gray. All his underside and his arms are washed with a reddish chestnut and between the red and black lies a band of hair as white as snow.

The squirrel's whole apartment is his gymnasium, but he is given added pleasure with an exercising wheel. Every compartment has one or more and they are almost constantly in use. During the day the big squirrels use them and in the night the tiny flying squirrels keep the wheels rolling. With squirrels it is a great sport. They will run furiously for a few minutes, leap out and back in again while the wheel goes on. Sometimes another squirrel leaps in, another and another, all becoming one swirling, leaping mass of fast-moving fur. Then one jumps out, and another, and another. The squirrels may turn around

A EUROPEAN RED

The great graceful ear-tufts grow on the common squirrel of Europe. None of our squirrels equal them, in this, though some try hard in winter to be good rivals



THE ROAD WITHOUT AN END

A rat in less than three years ran his wheel 5447 miles. A squirrel doubtless runs the circumference of the earth, if he lives to ripe old age

and race the other way. Perhaps one will try to keep pace on the outside of the moving drum, but rarely with success. I always think when watching them of the work that could be done if all this energy were harnessed.

Food is a pleasure to the squirrels and a problem to the owner of this "Ritz Squirrelton." Nuts of every sort, pine cones, vegetables, fruits, seeds—fully 57 varieties come to every squirrel. Then each must have his cod-liver oil on schedule to keep in best condition. Not every one will eat alike. Some that in old age—due to a bad early life—have lost their teeth, can take only soft food. It is a tribute to Doctor Powers that she can keep such poorly equipped squirrels in good health.

With all this easy life, every want but complete liberty supplied, no enemies about them, shelter in all weather, it would seem that the squirrels would never wish to leave, and this must be the case, for on rare occasions when venturesome spirits wandered away from their paradise, they soon found their way back. Doctor Powers once opened a little window in the roof of a screened balcony occupied by a group of flying squirrels, thereby giving them the opportunity to come and go. For a long time they went out at night and came back in the early hours. After awhile they located in the neighboring trees and only returned to the house to secure supplies. One of them still comes back to the house every night to run her exercising wheel. A Chinese squirrel gained liberty several years ago, went out and saw the world, and then apparently decided that there was no place like home and came back. Several gray squirrels were given the privilege of going and coming as they pleased. They make free use of this opportunity. Some come back to sleep in the house, others nest outside but come in to dine. One

sees the wild squirrels outside trying to get in more often than the squirrels inside trying to get out. Other animals sometimes are housed with the squirrels; guinea pigs, tree shrews, parrots, cockatoos and pheasants, but they are passing fancies.

If this great colony were just a hobby, giving pleasure to but one person, it might be hard to justify. But this has never been the case. Doctor Powers' collections have formed the bases for several scientific works; her records have all been carefully made and are remarkably complete. At this writing she is engaged on her first book, which promises to be a splendid story.

Perhaps it is not strange that it occurred to her to use her squirrels in moving pictures. It is remarkable, though, that even with all her resources she was able to make successful plays in which every actor was a squirrel. The squirrels probably knew no more about what they were acting than many Hollywood stars, but they did lend themselves willingly to the task. One little red squirrel became so thoroughly absorbed in her work under the strong lights that when her task was done she died of exhaustion but, as a good actor, waited for the final curtain. From her long labor Doctor Powers made six film stories which have been shown in the large theatres and museums and now are on the eve of achieving popularity in the home film libraries. They were all titled by a professional humorist who was partly in control, and have proved popular with all audiences. We find such titles for the plays as "The Romance of Curly Squirrel," "The Family Album," and "The Diary of A. Knutt." The leading comedienne of the films was a small red

ADOLESCENCE
All eyes and hands and feet, but accepting the commensalistic life of the Squirrel Farm as though it were the only one

squirrel named Hepsy, who continually tried to bury nuts in a tumbler of water and vigorously pushed them down beneath the surface as rapidly as they arose. One sees, too, the flying squirrels whose instinct to hoard food is so strong that they usually fill up their nest boxes so completely that they themselves cannot gain entrance.

In Scandinavian legend the squirrel was the messenger of the gods, carrying news to them of what went on upon the earth among the other animals. The legend does not tell us what the other animals thought of the squirrel. In the Red Squirrel Farm the squirrels keep their secrets to themselves. Among the Indians of New Brunswick a legend had it that the squirrel was an enormous creature and bore the name Miko. One day the Great Spirit asked an old man of the tribe what he most desired. The patriarch considered for a moment and then answered that more than any other thing he wished to have Miko reduced in size. Thereupon he received the divine mandate and went forth to the forest where he met the bold, bad squirrel. The old man raised his hand and Miko shrank to his present small proportions. To this day he has been querulous at the sight of man. Many of us have tried to overcome this fear and often, in our cities, some squirrels do become fairly tame.

All who have taken wild squirrels, though, and tried to make them members of a household, will know that Doctor Powers has done the all but impossible. Gentleness, quietness, perseverance, and some ingenuity, have been factors in her success in taming squirrels. She has made friends of creatures others keep as wild animals or kill.

Lucky is the squirrel who lives his life in the shelter of the Red Squirrel farm.

HEPSY, THE COMEDIENNE

Hepsy's instinct told her that all these fine nuts should be buried to provide against a future famine, but why the nuts would not stay under water when put there she could never understand

JONATHAN DWIGHT
1858-1929

By FRANK M. CHAPMAN
Curator-in-Chief, Division of Zoology and Zoogeography, American Museum

AFTER a prolonged illness, Dr. Jonathan Dwight died at his home in New York City on February 22, 1929, in the seventy-first year of his age.

Doctor Dwight was a research associate of the department of birds in the American Museum, and for the last twenty-five years the Museum has been his ornithological home. Here his collections were deposited, here he conducted his studies, and here, as a member of our staff, he shared in our counsels. His large and, in certain respects, unequalled collection of American birds, with the exception of a representative series bequeathed to the Museum of Springfield, Massachusetts, he left to the American Museum. Brought together with judgment and discrimination, it has exceptional scientific value. But as we refer to it, we will find that specimens alone cannot give us that special, authoritative information which Doctor Dwight always so generously held at our disposal.

Doctor Dwight was born in New York City in 1858 and lived here all his life. He was graduated at Harvard in 1880 in the same class with ex-President Roosevelt; and at this period both young bird students attended meetings of the Nuttall Ornithological Society of Cambridge, the local organization, which in 1888, gave birth to the American Ornithologists' Union.

Some years later Doctor Dwight took up the study of medicine and, in 1893, graduated from the College of Physicians and Surgeons. He practiced medicine for a short time from his then home at No. 2 East Thirty-fourth Street, and from 1894 to 1904 was assistant surgeon in the department of laryngology in the Vanderbilt Clinic. But his ever increasing interest in the study of birds and the attention demanded by his growing collections finally induced him to abandon medicine and devote himself exclusively to ornithology. Doctor Dwight's special field in this branch of zoölogy was a study of the laws underlying plumage changes and of the methods by which these changes were effected. It was characteristic of him to select a difficult problem, carefully lay his plans for its conquest, and then patiently, persistently, and with the utmost care proceed with his investigations. Quality, not quantity, was his motto. All that he did was well done. He was a pioneer in the study of the molt of birds; he formulated and helped us thoroughly to understand the laws governing the sequence of plumages. He combated, vigorously and effectively, the theory that pigmental change occurs in the mature feather, and demonstrated that the alleged cases of change in the colors of birds' plumage without molt were actually due to new feather growth or to wear in the old feather.

Doctor Dwight never fired until he was ready. But, when he did train his guns, victory was virtually assured. He did not become the leading authority on his subject without years of preparation. The earlier collectors of birds wanted only specimens in perfect plumage. During the molting season they either did not go afield or discarded specimens in worn or incomplete plumage. These, however, were the very birds that Dwight wanted. They told the story he was trying to put in words. But such specimens are not easy to acquire. When molting, birds are quiet and retiring. A special effort was therefore needed to secure the material essential to his studies. No small part of it he collected himself. After it was assembled, the technique required for its interpretation called for that tireless spirit of investigation with which Dwight was so abundantly blessed. Nearly thirty years have passed since his more important work on birds' plumages appeared.[1] It blazed a trail which has become a main traveled road.

The subject was endless, and Doctor Dwight treated it both objectively and philosophically. In "The Gulls of the World,"[2] his last important work, Doctor Dwight's special knowledge of plumage change was brought successfully to bear on problems in systematic ornithology which had long puzzled his predecessors.

If Doctor Dwight had not done so much for others he might have done more for himself. An Associate Founder (1883) of the American Ornithologists' Union, he was elected a Fellow in 1886, and up to his final illness never missed

[1] "Sequence of Plumage and Moults of the Passerine Birds of New York." *Ann. N. Y. Acad. Sci.*, XIII, 1900, pp. 73–360.

[2] The Gulls (Laridæ) of the World; Their Plumages, Moults, Variations, Relationships and Distribution. *Bull. Amer. Mus. Nat. Hist.*, LII, 1925, pp. 63–401; 384 figures; 10 colored plates.

attendance at the annual meetings of the Union. His devotion to the affairs of the Union was further expressed in the long period (1903–1920) during which he served as its treasurer.

To the National Association of Audubon Societies he also gave freely of his time. He was a director (1908–1929) and member of its executive committee from 1910–1929, and its treasurer from 1908 to 1929. The Linnæan Society was his especial charge. He was elected one of its first members, and for years rarely was absent from its meetings; while from 1901 to 1921 he filled the office of president. It was, therefore, particularly appropriate that he should receive the medal of this Society, which was awarded him on February 19, 1929.

For seven years (1889–1896) Doctor Dwight was a member of the Seventh Regiment of the National Guard, and at this time won distinction as a rifle shot. He was twice married,—in 1901 to Georgina Gertrude Rundle, who died in 1903; in 1914 to Ethel Gordon Wishart Adam, who survives him.

Doctor Dwight wrote his name for all time in the annals of the science of birds, but it is engraved far more deeply in the hearts of his friends. He was a lovable man; gentle, kindly, considerate, and courteous. He inspired confidence that never was misplaced. He was responsive and sympathetic, a friend to share one's sorrows as well as one's joys. His own standards were of the highest and he adhered to them, but such was the generosity of his nature that he never sat in judgment on his neighbor. Never did I hear him speak ill of others; never did I hear others speak ought but good of him.

WHO'S WHO IN "NATURAL HISTORY"

Dr. Roy Waldo Miner, curator of marine life at the American Museum, has devoted many years to the study of marine life along the New England coast; he has taken part in several expeditions to Porto Rico and the Lesser Antilles, and more recently visited the Bahamas, where, with the aid of the Williamson submarine tube he descended to the floor of the sea, obtaining photographs and specimens from the living coral reef at Andros. The results of the expeditions and studies have crystallized especially in many exhibits for the Darwin Hall including the recently completed Rotifer Group, and the great Coral Reef Group now under construction for the Hall of Ocean Life.

In "Outposts of the Sea" Doctor Miner touches briefly upon one of the great acts in the drama of evolution, a theme which will be developed in greater detail in a volume under preparation.

James L. Clark, author of "By Motor from Nairobi to the Nile," is assistant director of the American Museum, in charge of preparation—that is, in charge of the preparation of all material used in the exhibits of the Museum. Articles by him have appeared often in NATURAL HISTORY, and his book, *Trails of the Hunted*, recently published, tells in detail the story of his twenty-five years of work in the field and in his studio. Mr. Clark is a sculptor as well as a taxidermist, and his hunting has taken him to Africa three times, across Asia once, and many times he has been in the field in North America.

In July, 1928, **Mr. Sidney Tyler**, who has written "Children of the Orinoco Plains" for this issue of NATURAL HISTORY, financed the Tyler-Duida Expedition sent out by the American Museum, and accompanied the expedition to Mount Duida, which lies in Venezuela far up the Orinoco River. He was to be historian and photographer of the trip, but having arrived at Mount Duida, he was forced to accompany another member of the expedition, who became ill, to the jungle headquarters of a physician who also was exploring on the upper Orinoco. During this difficult journey Mr. Tyler was himself taken sick, and the physician, while permitting Mr. Tyler's companion to rejoin his party on Mount Duida, advised against Mr. Tyler's return. He consequently came back to the United States, but is now once more on the Orinoco River—this time with Dr. Herbert Spencer Dickey—in an effort to discover the source of the Orinoco, which is the only large river in the world the source of which is still unknown.

About a year ago the editors of NATURAL HISTORY received a large envelope from **Mr. David Locke**, mailed from Corpus Christi, Texas. The enclosures were the manuscript of an article entitled "Seeds of Disaster" which appears in this issue of the magazine, and a letter asking whether the author was correct in his surmise as to the cause of the tragic defeat of the ant colony he had so carefully watched while living in the town of Santa Cruz de la Sierra, Boliva. The editors, being unable to answer the question, submitted the article to Prof. William Morton Wheeler of Harvard, who is also on the staff of the American Museum, in order to get the opinion of this outstanding authority on ants.

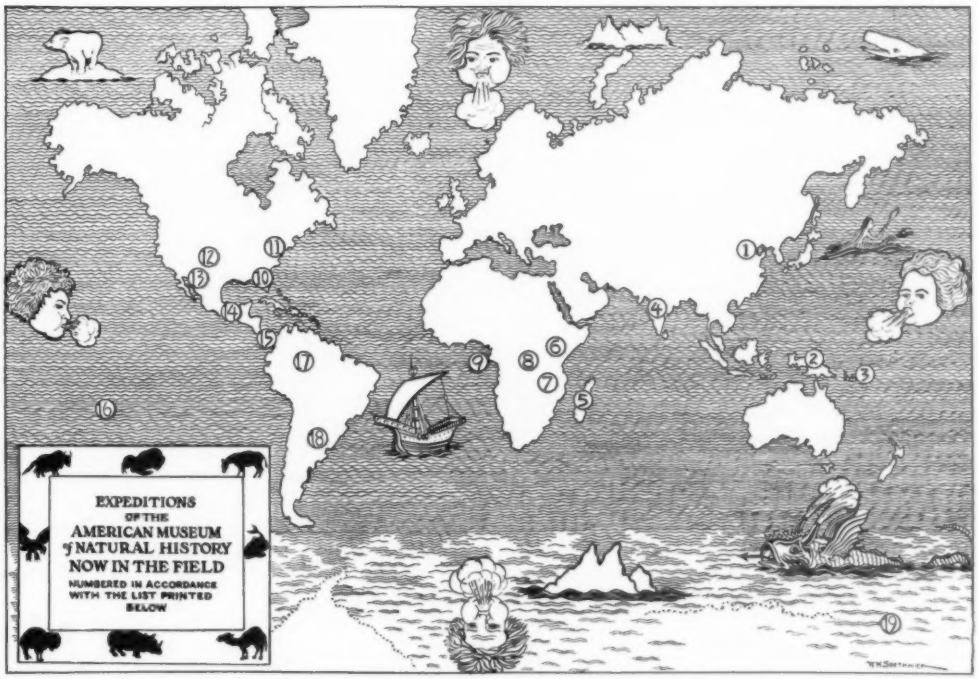
Even Professor Wheeler, however, could not be certain whether Mr. Locke's surmises are correct. Such a tragedy is not a matter of record, but it may be that Mr. Locke's conclusions are correct. In any event, Mr. Locke. —as well as the editors of NATURAL HISTORY—are endeavor-f ing to find out what *did* happen if Mr. Locke's surmises are not correct. If any of the readers of NATURAL HISTORY can positively bear out or confute Mr. Locke's surmise, the editors would appreciate hearing from them.

W. Henry Sheak, who has contributed "Acrobats of the Monkey World" to this issue, was graduated from the old United Brethren College at North Manchester, Indiana, with the Bachelor of Literature degree, but his student days have stretched from the cradle down to the present hour. He prepared for the ministry, but has spent most of his time in writing for newspapers and magazines, in the study of natural history, and in lecturing on animals. He created a sensation in the church and among the newspaper fraternity by joining a circus, where he earned the title of Circus Chaplain. He has traveled with Barnum and Bailey, the Ringling Brothers, John Robinson, and several exclusively animal shows. He has studied in all the great zoological gardens and natural history museums of America, and has spent much time in original research in field and forest.

In Japan an important part of the education of the cultured classes is a thorough knowledge of the ancient literature and traditional dramas of that country. The *No* plays and songs are famous among these, and **Mr. S. Ichikawa**, author of "Masks and Dramas of Old Japan," who has made a special study of them, gives a brief outline of their history and development. Mr. Ichikawa is in charge of the care and arrangement of the Japanese and Chinese Halls at the American Museum, and recently accomplished the restoration of the mosaic disc found at Chichen Itza.

Previous to his connection with the American Museum as assistant curator in the department of education, **William H. Carr** had much experience in establishing outdoor museums for the Boy Scouts and similar organizations. He also was editor of *The Camp Naturalist*, a periodical devoted to camp life. For the last three years Mr. Carr has been resident naturalist at the Bear Mountain Nature Trails in Palisades Interstate Park. Here, during five months of each year, he has been developing the Trails and the Trailside Museum that are being operated by the American Museum in coöperation with the Commissioners of the Palisades Interstate Park.

A day at the Nature Trails is described in Mr. Carr's "Trailing Nature."



1. Central Asiatic; 2. Beck, New Guiana, for birds; 3. Whitney South Sea, Solomon Islands, for birds; 4. Vernay-Faunthorpe for Asiatic mammals; 5. Madagascar for birds, mammals, and fossils; 6. Sanford-Legendre, Abyssinia for mammals and birds; 7. Straus, Nyasaland for birds; 8. Tanganyika for birds and mammals; 9. Thorne-Correia, Sao Thomé for birds; 10. Wm. G. Hassler, Florida for reptiles; 11. Chester A. Reeds, Lake Passaic varves; 12. Bernheimer, Southern Utah, for fossils; 13. Frick-Rak, Sante Fé, for fossils; 14. Vaillant, Mexico, for archæological finds; 15. Benson, East Panama, for birds; Blick, Honduras for fossils; 16. Shapiro, Polynesia, physical anthropology. 17. Tyler-Duida, Venezuela, for birds and mammals; 18. Naumburg-Kæmpfer, Southeastern Brazil, for birds; 19. Byrd, Antarctic

IN THE FIELD OF NATURAL HISTORY

Expeditions — Scientific Research — Conservation
Books — Meetings of Societies

EDITED BY A. KATHERINE BERGER

EXPEDITIONS

THE SEVENTH BERNHEIMER EXPEDITION of the American Museum left New York on May 15. It will explore three different localities in the Montezuma Creek region of Southern Utah, where one of Mr. Bernheimer's guides has located dinosaur bones of major size. Mr. Barnum Brown, the Museum's curator of fossil reptiles, is accompanying the party, and will remain on the ground for some time. The expedition will then proceed westward in quest of new archæological data. Earl H. Morris, archæologist at the Carnegie Institution, is also with the expedition.

TYLER-DUIDA EXPEDITION.—G. H. H. Tate, leader of this expedition, has returned to New York, thus bringing to a close a most successful collecting trip for birds and mammals of that previously unexplored territory of South America.

THE SANFORD-LEGENDRE ABYSSINIAN EXPEDITION has informed the Museum by cable of noteworthy success in collecting a group of nyala. Complete material has been secured, comprising males, females, and young. The largest bull secured had horns 40 inches along the curve. Among other specimens secured for the Museum collections are the Abyssinian red wolf, the black bushbuck, Abyssinian duiker, oribi, and klipspringer. The expedition expects to go to the Omo River and later to the Kaffa Forest to try for Museum desiderata.

MR. WILLIAM J. MORDEN, field associate in mammalogy, American Museum, and Mr. George Graves, who is now on an expedition to the Arctic, are to head an expedition that will spend the winter of 1929–30 in Siberia in search of long-haired Amur River tigers. Mr. Morden

will leave in August for Turkestan in order to collect the saiga antelope, and will be joined in November by Mr. Graves. Together they will collect in the Amur River district during the winter. NATURAL HISTORY Magazine will publish further details of the expedition in the next number.

ASTRONOMY

The Amateur Astronomer, official journal of the Amateur Astronomers Association, made its initial appearance the latter part of April. It will be published on the 15th day of each month, except in July and August, under the editorship of Dr. Clement S. Brainin of the department of astronomy, Columbia University, and it is expected that it will prove of the utmost possible service and interest to the members of the Association.

A supplement issued with this first number bears a facsimile of the highly appreciated original letter of greetings sent by Prof. Albert Einstein to the Association on April 8, together with the following translation:

> Science must set itself not only the task of ever making progress. In the first instance, made possible by the daily work of the community at large, science should in turn bring to the community both enjoyment and edification. In this sense, I wish your undertaking every success.
>
> —A. EINSTEIN

A map of the night sky for April and May also appears in this issue.

AT ITS APRIL 17TH MEETING, the Amateur Astronomers Association presented a scroll to Mr. Worcester Reed Warner, electing him to honorary membership in the society, in recognition of his outstanding service to Astronomy. Most noteworthy among his achievements are the designing and constructing, on three successive occasions, of the largest telescope in the world, namely, the 36-inch Lick Refractor, the 40-inch Yerkes Refractor, and the 72-inch Vancouver Reflector.

Mr. Warner was also the speaker of the evening, the subject of his address being "A Starry Night at the Lick Observatory."

DR. W. H. STEAVENSON, F.R.A.S., of London, will give an illustrated talk on "William Herschel, the Father of Amateur Astronomy," on Wednesday evening, June 5. This will be the first time the Amateur Astronomers Association will have the pleasure of being host to a guest speaker from a country other than the United States.

EDUCATION

THE SECOND ANNUAL CHILDREN'S FAIR.—In coöperation with the American Museum of Natural History and School Nature League, the American Institute will hold its second Children's Fair at the Museum next October. The first fair was attended by more than 36,000 children and adults. A total of 130 awards was given for the best exhibits and 3000 children participated.

The annual Institute Children's Fair is "designed to focus attention on the sciences and to foster a scientific interest in agriculture, gardening, nature study and conservation," among New York school children. All pupils under eighteen years of age residing in any of the five boroughs of Greater New York are eligible to exhibit.

Individual entries this coming fall will include homemade terraria, exhibits illustrating biological principles, exhibits relating to geology, and living as well as mounted insects. There will be a special section devoted to astronomy, including displays showing changes of the seasons and their causes, phases of the moon, studies of the various constellations, and homemade telescopes.

Entry of models and apparatus relating to the physical sciences and inventiveness in the city home will be encouraged for the purpose of stimulating the ingenuity of New York City children. Another new feature of this year's fair is the entry class called "Chemistry in the Home."

Camps, public and private schools, and parks will be allowed to exhibit as organizations. These displays will appear under the following classes: Gardens, Conservation of Forests and Wild Flowers, Conservation of Birds and Animal Life, Park and Roadside Conservation, Conservation in Industry, Conservation of Health, Biological Principles, Plants, Economic Crops, Plant and Animal Life for Classroom Use.

ART STUDY IN THE PUBLIC SCHOOLS.—The largest and most ambitious public display of art work done in the regular classes of the New York public schools was on exhibit at the American Museum for three weeks, beginning March 25. The contributions were grouped in three sections senior high, junior high, and elementary schools —each individual high school having its own wall space.

Drawings and paintings on paper and canvas were displayed, as well as pottery, sculpture, wall hangings, and shop work which showed particularly the influence of art study on mechanical operations.

Miss Edith L. Nichols, assisted by a corp of helpers, was in charge of the exhibit.

THE JAPANESE ASSOCIATION held an art exhibit in the Education Hall of the American Museum from April 22 to May 10. All the exhibits were made by children in Japanese elemen-

tary and junior high schools, and were sent here under the supervision of the Japanese government for the purpose of increasing international good will by giving American children an opportunity to compare their work with that done by Japanese children.

On May 5 (Boys' Day in Japan), Japanese children dressed in native costume gave an entertainment at the American Museum which included Japanese songs, a one-act play, and special motion pictures on Japan. The children in the audience were presented with rice cakes.

CRIPPLED CHILDREN GUESTS OF THE MUSEUM.—One of the annual activities of the School Service Department of the American Museum is acting as host to groups of crippled children, both in and out of school. Private cars or buses bring the children to the Museum, where special wheel chairs are provided to take them through the exhibition halls.

One group of about 20 children, who are not able to attend school, visited the Museum on April 18. After a tour of the halls, luncheon was served to them in the Hall of Birds of the World. For some of these children, this outing was their first trip from home this year. One child, ten years old, had never been away from home before.

Another group of 400 crippled children were guests of the Museum on April 25. They were entertained with a motion picture of animals that live in the vicinity of New York.

BAKER MEMORIAL PROFESSORSHIP. — The Board of Regents of the University of the Philippines has established a Baker Memorial Professorship in the College of Agriculture in memory of Charles Fuller Baker, who was dean of the College of Agriculture from 1917 until his death in July, 1927.

This professorship provides for the services in the college of a man from abroad, who shall be in residence in the college eight months at least and shall carry a teaching load of five hours a week. It is the purpose to secure men who are specialists in the different sciences allied to agriculture. This professorship in honoring Dean Baker provides for incalculable benefit to the college which in itself is a fitting tribute to a man whose services to the institution were so valuable.

THE JUNIOR ASTRONOMY CLUB has shown a phenomenal growth in the two months of its organization, and announces an active membership of more than 750 boys and girls. A monthly paper, *The Junior Astronomy News*, is being published, the board of editors and contributors all being members of the club.

The section for the children of members will meet Friday, June 28, at 3 o'clock, and the general section Saturday, June 29, at the same hour. At both of these meetings sun spots will be the study topic, with an introductory talk by Dr. Clyde Fisher, who will also have charge of the observation with the telescopes. The June meetings will mark the close of club activities for the season. Meetings will be resumed in September.

The groups were organized by Miss Elizabeth A. Eckels, staff assistant in the Museum's division of education.

BRAZIL SUMMER SCHOOL.—Brazil is offering for the first time a summer school from June 29 to August 27, for North American vacationists, whether students, teachers, internationalists, or professional men. The summer school is under the supervision of the Brazil Research Institute, a subsidiary institution of the Instituto Historico e Geographico Brazileiro, and leading scientists and scholars of Brazil will give the lectures, all in English except that on tropical biology, which will be given in French.

The subjects covered by the lectures are Physical Geography and Topography of Brazil; the Political and Social Development of the Brazilian People; the Historical Evolution of Brazil from the Period of Colonization to the Present Economic and Industrial Status of Brazil; and Tropical Biology as Observed in Brazil.

A special tour has been arranged to leave New York, June 29. Full information may be obtained from the Institute of International Education, 2 West 45th Street, New York City.

EXPERIMENTAL BIOLOGY

TO CUBA FOR REPTILES.—Mr. C. Ralph DeSola, who was a member of the New York Zoological Society's recent expedition to the Galapagos Islands, is traveling in Cuba in the interest of the department of herpetology and experimental biology of the American Museum. Reptiles have always proved difficult material in the laboratory because of their requirements of temperature and ultra violet. There are in the West Indies a number of nocturnal lizards which have proved particularly hardy, as they often arrive in shipments of bananas or other produce from the tropics. The life histories of these species are known only in part and Mr. DeSola hopes to work out their life cycles while obtaining a series alive for the American Museum. A wide knowledge of reptiles, and a perfect familiarity with the Spanish language make Mr. DeSola well qualified to carry on these studies.

METAMORPHOSIS IN AMPHIBIA.—One of the recent achievements of the Museum's new department of experimental biology was the demonstration that *Cryptobranchus*, an aquatic salamander, which never metamorphoses completely, could be made to metamorphose in part by means of thyroid treatment. In continuing these observations on the processes of metamorphosis in amphibia, Mr. Wm. G. Hassler of that department, left late in April for Florida to collect numbers of another aquatic species,—*Siren*, for similar investigations. If *Siren* and *Cryptobranchus* could be induced by any experimental treatment to metamorphose completely, they would change into a type of animal which has never been seen by man, for the metamorphosed form of no true perennibranch has ever been obtained either in the laboratory or in nature.

Incidentally, the eggs of *Siren* have never been described, and Mr. Hassler hopes to work out the life history of the form. A quarter of a century ago the importance of larval stages in indicating relationships attracted the attention of many zoölogists. Many ichthyologists, including the late Dr. Bashford Dean, made important discoveries in studying the life histories of fishes. Very recently, to a large extent through the efforts of the herpetological staff of the Museum, the importance of life history data in demonstrating the relationships of amphibia have been brought to light. The field work which Mr. Hassler is undertaking is, therefore, of interest from several standpoints.

AMPHIBIANS AND REPTILES

COURTSHIP OF SALAMANDERS.—Dr. G. K. Noble attended the recent meeting of the American Society of Herpetology and Ichthyology held April 9–10 at Ann Arbor, Michigan. He presented a paper on the courtship of the common two-lined salamander, which had not been hitherto described. Of special interest was the description of a series of distinctive glands scattered over the body of the male and apparently serving to attract the female. The two-lined salamander produces stalked spermatophores which are carried within the cloacal lips of the female for long periods.

THE BREEDING OF THE SLIMY SALAMANDER.—It will be of interest to local naturalists to know that the eggs of the common slimy salamander, *Plethodon glutinosus*, have at last been found. Dr. G. K. Noble and Mr. B. C. Marshall in a recent number of *Novitates* describe the eggs of the common species for the first time. They were found in caves far underground. Development is direct and the young salamanders never enter the water at any stage of their life history.

CHINESE AMPHIBIA.—Dr. Alice M. Boring of Yenching University, Peking, China, has recently spent several weeks studying the Museum's extensive collections of Chinese amphibians. After her return to China, this summer, Dr. Boring will instruct her students in the taxonomy of Chinese frogs and toads, in addition to working on special problems herself. It is hoped that the study of Chinese herpetology will receive considerable stimulus as a result of this initial effort.

FROG PHOTOGRAPHY.—Mr. Wm. G. Hassler and Mr. E. J. Farris, of the department of herpetology and experimental biology, have succeeded by the use of flares in taking the first motion picture of breeding frogs ever made in nature at night. Several excellent shots of wood frogs and other species were obtained. The picture was shown at a recent meeting of the Linnæan Society when Mr. J. A. Weber, Mr. Hassler, and Doctor Noble discussed some of the local herpetological problems of interest to the New York field naturalist.

BIRDS

THE GREAT WHITE HERON, subject of Mr. Jansson's striking cover design for this issue of NATURAL HISTORY, should not be confused with the great white egret. Both are herons, both are white, but there the resemblance ends. The egret is a much smaller bird that during the breeding season bears aigrette plumes growing from its back. It breeds from the more southern United States southward to Argentina, inland as well as along the coast.

The great white heron is as large as the great blue heron. It bears no aigrettes, and in the United States it is known to nest only in the keys and on the coast of southern Florida. There it was discovered and, in 1835, named by Audubon. Since then it has been an open question whether *Ardea occidentalis*, as Audubon called it, was a distinct species or a white color phase of the southern great blue, or Ward's heron. The belief that they were one and the same species was supported by the fact that they interbreed, producing young like both parents, as well as others intermediate between the two. The latter was described by Professor Baird as Wuerdmann's heron (*Ardea wuerdmanni*). We have in the American Museum three young herons which I found in a nest on Clive Key, southeast of Cape Sable, on March 27, 1908. Two are in the grayish plumage of Ward's heron, the other wears the pure white of the great white heron. One of the parents was of the last-named species, the other

was probably a specimen which unfortunately I collected as I landed on the key before I knew that birds were nesting there. It is a Ward's heron with some of the characteristics of Wuerdmann's heron.

In the succeeding years additional data have accumulated and a consideration of them, in connection with his own experiences, has led Mr. Ernest G. Holt, in a paper published by the Cleveland Museum of Natural History, in 1928 (*Scientific Publications*, Vol. I, No. 1) to express his belief that Ward's heron and the great white heron are distinct species which hybridize. The evidence supporting this view is presented at length and seems conclusive.

It is a matter of especial interest that a large part of the breeding range of the great white heron is contained in the proposed new Everglades National Park, the characteristics of which are described by Mr. Ernest F. Coe, in *American Forests and Forest Life* for March, 1929. The case illustrates the extreme importance of conserving this unique area, where members of forms of animal life once common in Florida are now making their last stand.—FRANK M. CHAPMAN.

THE JOHN BURROUGHS MEMORIAL ASSOCIATION MEDAL
Awarded to Dr. Frank M. Chapman

HONORS

Three years ago the JOHN BURROUGHS MEMORIAL ASSOCIATION inaugurated the policy of awarding a medal to the author publishing, during the year preceding the annual meeting, the best piece of nature literature, either prose or poetry. This was felt to be a most fitting function of the Association, since John Burroughs' great work was that of a literary naturalist. From *Wake-Robin*, written in the Eighteen-Sixties, to *The Last Harvest*, published posthumously, he himself set a high standard in nature writing. His great legacy to mankind is his books, and he has succeeded in putting himself in his books as few men of letters have done.

The first medal awarded went to William Beebe, nature essayist; the second to Ernest Thompson Seton, biographer of the animals; the third to John Russell McCarthy, poet of the outdoors. This year the committee found no outstanding production of our nature-writers. Therefore, it was voted that the time-limit be waived, and that the award be made to DR. FRANK MICHLER CHAPMAN for his nature writing of the past years, without specifying any particular book.

It will be of interest to state that the committee learned, after voting the present award, that Doctor Chapman has written a book during the past year upon the wild life of Barro Colorado in Gatun Lake, Panama Canal, of a kind that the asssociation feels would have been approved by John Burroughs. The book has just been completed, but has not yet been published. Had this book been actually in print, it is probable that the award would have gone to Doctor Chapman without the suspension of the time-limit requirement.

Dr. Clyde Fisher, president of the John Burroughs Memorial Association, made the presentation. On account of the unavoidable absence of Doctor Chapman, Dr. Robert Cushman Murphy received the medal on his behalf.

RAY LYMAN WILBUR, Secretary of the Interior, has invited Dr. Clark Wissler, curator-in chief of the Museum's department of anthropology, to serve as a member of the advisory committee of seven to consider the educational and recreational use of national parks and monuments.

Doctor Wissler has also been elected a member of the National Academy of Sciences.

At the annual meeting of the American Society of Mammalogists, held in Ann Arbor, Michigan, April 9–13, 1929, PRESIDENT HENRY FAIRFIELD OSBORN was elected an Honorary Member by unanimous vote of the Society. This class of membership has been voted to but few scientists, and is given in recognition of outstanding and meritorious contributions to mammalogy.

IN RECOGNITION of the splendid practical assistance given to Mr. Arthur Vernay and Col. J. C. Faunthorpe in securing specimens of Indian game for exhibition in the American Museum, His Highness, the Nawab Sahib of Junagadh State, Maharaj Kumar Sadul Singh of Bikanir, Rájputána, and Major F. Tinley, M.C., have been elected to Honorary Life Membership in the American Museum.

HISTORY OF THE EARTH

PRE-CAMBRIAN EURYPTERIDS.—In a recent letter, Prof. T. W. Edgeworth David of the University of Sydney, Australia, writes to Prof. Henry Fairfield Osborn concerning the finding, last year, of a "Lipalian" fossil marine fauna of Pre-Cambrian age in the hills around Adelaide, South Australia. Doctor David states that the strata containing this fauna range from 8000 to 14,000 feet in thickness, and that they lie below the base of the lower Cambrian rocks. The fauna is wonderfully interesting; its outstanding feature being the enormous dominance of large Eurypterids of an archi-eurypterid type. He remarks that they were so abundant in a bed of limestone five feet in thickness that fragments, small and large taken together, occurred at the rate of about 2000 for each square foot. This is a large number for a single bed. This bed, however, is but one of many, in a thickness of 6000 feet, which carries this very primitive fauna.

In 1906, Dr. C. D. Walcott, late secretary of the Smithsonian Institution and former director of the U. S. Geological Survey, recorded fragments of plates and pieces of small limbs of what he held to be Eurypterids, naming the form *Beltina danai* from the Pre-Cambrian Proterozoic Belt Series of Montana, U. S. A. Since Eurypterids are abundant in Silurian and Devonian rocks, most palæontologists questioned Walcott's determination of these crustacean remains as those of Eurypterids, but Professor David states that the evidence which has lately been collected in South Australia is absolutely conclusive that in Pre-Trilobite times the seas of this part of the world, and probably the whole world over, were dominated to an extraordinary extent by primitive Eurypterids about one foot to two feet in length.

Professor David published a preliminary paper on these remarkable fossils in 1928. Within a short time he hopes to contribute one or more additional articles to the *Journal of Geology*, Chicago, on this very ancient marine fauna. All geologists welcome Professor David's astonishing find. May it provide material for another chapter to his new book, *Geology of Australia*, which recently appeared.—C. A. REEDS.

DISTINGUISHED GUESTS

DR. C. C. WU, Chinese Minister to the United States, Madam Wu, and their party, were guests of the American Museum on Sunday afternoon, May 5. Director and Mrs. Sherwood, Mr. Douglas Burden, Prof. Charles P. Berkey, Mr. Barnum Brown and Mr. Pindar received the visitors and conducted them on a tour of inspection through the exhibition halls. Particular attention was given to an examination of the Museum's educational activities in coöperation with the public schools system of New York City. After the inspection, the party gathered in the Members' Room for tea.

MAMMALS

CURATOR H. E. ANTHONY attended the annual meeting of the Mammalogists at Ann Arbor, Michigan, as a representative of the American Museum of Natural History. He gave a lecture on the evening of April 12, entitled "A Cross-section through the Sudan," which was an account of the Taylor-Sudan Expedition.

THE MUSEUM ACQUIRES A 1500-POUND MANATEE.—Mr. Paul Moore, Jr., of Convent, New Jersey, recently presented to the American Museum a large manatee, estimated to weigh 1500 pounds. The specimen came from Lake Worth, Florida, where it was struck and killed by the propeller of a speedboat. According to Captain Lockwood, three large manatees, resting on the bottom of the channel, had risen, startled, to the surface of the water. One of the creatures struck the propeller and its back was ripped open, causing damage to the boat.

MARINE LIFE

THE CONSTABLE COLLECTION OF SHELLS.—By the will of Mrs. Frederick A. Constable the valuable and important collection of shells gathered by the late Frederick A. Constable during the years 1889–1897 was bequeathed recently to the American Museum. This remarkable collection includes a wide diversity of species noted for rarity and beauty, numbering many thousands. Its value may be conservatively estimated at the

present time as at least $30,000. Selections from the collection were recently on temporary exhibition in Education Hall and have been permanently placed in the Hall of Ocean Life, where they may be seen by the public when that hall is completed.

SCIENCE OF MAN

RACIAL SURVEY OF THE POLYNESIAN ISLANDS.—Several years ago the American Museum agreed to coöperate with the Bernice P. Bishop Museum of Honolulu in a study of the Polynesian race. The home of this interesting people ranged from New Zealand on the south to Hawaii on the north, occupying the intervening islands, Samoa, Tahiti, etc. This study was begun several years ago by the collection of bodily measurements, plaster face casts, and photographic studies of native Hawaiians. Similar data from Samoa and the Marquesas were collected by the staff of the Bishop Museum. Dr. Harry L. Shapiro of the American Museum is now on his way to Tahiti to complete this survey of the Polynesian race, and to make a final analysis of the data with a view to determining the origin of this interesting people. A full-sized figure of a Hawaiian man, cast from life, is on exhibition in this Museum. Like other Polynesians, the Hawaiians are tall, well proportioned, with smooth dark brown skin, handsome features, and pleasing in manner.

PRE-COLUMBIAN SAND-DUNE BURIALS IN HAITI.—When Columbus discovered the West Indies, he found there a well developed race of Indians, practicing agriculture and well skilled in pottery and other primitive arts. Recently, Mr. John J. Naugle of New York City called the attention of the American Museum to a number of sand-dune burials near the city of Santo Domingo, upon what is usually known in this country as the Island of Haiti. These burials seem to have been made before the time of Columbus and during a period when the heads of infants were artifically flattened to give a sloping forehead. With the assistance of Mr. Naugle, it was arranged to send Dr. Harry L. Shapiro to explore these sand dunes. In Santo Domingo, Doctor Shapiro was the guest of Mr. Thomas Howell, upon whose plantation the graves had been discovered, and due to Mr. Howell's generous hospitality, he was able to make trial excavations in several places. These diggings yielded a quantity of pottery and some skeletons. One unique find was a bone image of excellent workmanship, evidently representing a god. The Museum is very grateful to Messrs. Naugle and Howell for the opportunity to collect this interesting material.

OTHER MUSEUMS

DR. HERBERT SPENCER DICKEY, who has spent twenty-seven years in South America, left New York, April 25, on an expedition in the interests of the Museum of the American Indian, Heye Foundation, to discover the headwaters of the Orinoco River and to explore the wilderness of the upper Orinoco Valley. This territory, consisting of 3800 square miles, has never before been trodden by white man. Doctor Dickey will also seek a tribe of white Indians which, it has been reported, exists there.

Sidney F. Tyler, Jr., who sponsored the American Museum Tyler-Duida Expedition, and C. F. Polsten, topographer and radio operator, will accompany Doctor Dickey. The party expects to be away at least six months.

MEETINGS OF SOCIETIES

THE FIFTEENTH INTERNATIONAL GEOLOGICAL CONGRESS will be held at Pretoria, South Africa, from July 29 to August 12. The American Museum will have as its representatives at this congress Dr. Robert Broom and Prof. Charles P. Berkey.

THE FIFTIETH ANNIVERSARY of the appointment of Clarence King as first director of the Geological Survey was celebrated at Washington on March 21. Among the distinguished speakers for this occasion were Secretary of the Interior Ray Lyman Wilbur, who spoke on "Science in the Govermnent," and Prof. Henry Fairfield Osborn, whose subject was "Thomas Jefferson, Pioneer of American Palæontology."

DR. F. O. COLVLLE represented the American Museum at the Fourth Pacific Science Congress which was held in Java during May.

MEMBERS' DAY

In order that its members might become more familiar with the great institution of which they are a part, the American Museum on April 24 inaugurated a Member's Visiting Day. Four hundred and fifty members and their guests availed themselves of the opportunity—many coming to the Museum from distant points. A reception committee composed of members of the Museum staff, conducted the visitors in small groups through several laboratories, the preparation department, and exhibition halls not yet opened to the public.

Following this tour, Director Sherwood greeted the members in the auditorium and showed a motion picture of Museum exploration. Dr. G. Kingsley Noble spoke on current research problems and the practical application of research work.

Tea was served in Education Hall where the Japanese School exhibit had just been opened.

So great was the appreciation of the guests that the Museum is planning to establish an annual Members' Visiting Day.

NEW BOOKS

Our Face from Fish to Man. By William K. Gregory. pp. 295. With 118 illustrations. Putnam's, New York. 1929.

The story of the changes which our face has undergone since our early ancestors swam the coastal seas has been enchantingly and convincingly narrated by one who is better qualified than any other man to write this history. This story, documented in the rocks and in our very faces, has been pieced together for the layman into language free of all the puzzling intricacies of the original record. Skin-deep beauty is peeled away to show the true family characters that are hidden just beneath the surface. Flesh and bones, smiles and tears, all help to round out the picture. The skeleton of the book is bone, but the text is not "bone dry." Illustration, though in some cases abstract, is unusually complete, and well fitted to the book. Doctor Gregory has dedicated his work to Prof. Henry Fairfield Osborn.

—R. T. H.

ERRATUM

In "Our Contributors" column of the January-February issue, it was erroneously stated that Prof. and Mrs. T. D. A. Cockerell had developed a new species of sunflower. The facts are that Mrs. Cockerell found close to her home a "sport" with reddened rays, in no sense a species. Starting with this, crosses were made with the various cultivated sorts, giving a wide range of horticultural varieties, which are still to be obtained from Sutton in England and other seed firms.

NEW MEMBERS

SINCE the last issue of NATURAL HISTORY, the following persons have been elected members of the American Museum, making the total number 11,142.

Honorary Life Members

HIS HIGHNESS THE NAWAB SAHIB.
MAHARAJ KUMAR SADUL SINGH.
MAJOR F. TINLEY.

Life Members

Mesdames CARL S. PETRASCH, ANNA L. REILLY, CHARLES A. SPOFFORD, RUSH TAGGART, SAMUEL THORNE, GRAHAM FAIR VANDERBILT.
Misses FLORENCE E. QUINLAN, GERTRUDE S. THOMAS.
Messrs. LORILLARD SPENCER, EDGAR SPEYER, CHAUNCEY D. STILLMAN, ROBERT G. STONE, A. VARICK STOUT, JR., JOHN F. TALMAGE.

Sustaining Members

Mesdames G. MACCULLOCH MILLER, H. W. SIBLEY.
Miss VIRGINIA THAW.
Messrs. HOWARD BOULTON, OSCAR R. LICHTENSTEIN, L. CORBIN STRONG, EDWARD WELLES, JR.

Annual Members

Mesdames STANLEY W. BURKE, VICTOR W. LOGAN. WM. H. SCHMIDT, HENRY SCHNIEWIND, ROBERT RYLAND SIZER. CHARLES RAYNOR SMITH, ALEXIS SOMMARIPA, HENRY B, SPELMAN, EMIL STEIN, MARIE-LOUISE STURSBERG, THOMAS W. SWAN, SWEN ALBIN SWENSON, SAMUEL THOMAS, J. NORRISH THORNE, JOHN C. TOMLINSON, JR., HOWARD E. WURLITZER.
Sister M. ROSE.
Misses S. LOUISE BELL, ANN BELLIS, MARION COATS, AUGUSTA S. KALBFLEISCH, ANTOINETTE Q. SCUDDER, MARGUERITE D. SHEPARD, AUGUSTA P. SLADE, MARIAN SWIFT, AGNES GORDON TACK, FRANCES V. WARNER, MARIE ZIMMERMANN.
Doctors W. N. BERKELEY, PETER E. DEMAREST, DOUGLAS QUICK, E. DOUGLAS RUDDEROW, MORRIS K. SMITH, ANTONIE P. VOISLAWSKY.
Captain MONROE MAYHOFF.
Messrs. ALFRED L. AIKEN, LOUIS AYRES, GORDON K. BELL, JR., CHARLES BELLINGER, DAVID D. BELLIS, ANTHONY DESIMONE, JOHN J. DUFFY, P. A. L. ENGELBREGT, M. DOUW FERRIS, JR., CARL GERDAU, ALEXIS G. GRAAM, VICTOR GRAEB, ALWYN M. HARTOGENSIS, JACQUES HETTEIX, HAROLD M. HIRSH, SYDNEY S. JALKUT, ELLERY S. JAMES, THEODORE H. JOSEPH, S. VERNON MANN, MAX MEYER, HUDSON MILLARD, HUBERT S. MORGAN, ALFRED PINCUS, LYONEL H. PUTNAM, ARCHIE M. RICHARDS, THOMAS ROBINS, GODDARD WELD SAUNDERS, WM. B. SCARBOROUGH, ERNEST H. SCHELLING, ROBERT W. SHERWIN, LEON GILBERT SIMON, AUGUSTUS H. SKILLIN, CHAS. ROBINSON SMITH, JOSEPH LINDEN SMITH, HERBERT C. SMYTH, JR., HAMILTON SOUTHWORTH, L. LEE STANTON, MASON B. STARRING, EDW. R. STETTINIUS, JR., H. F. STONE, EDWARD STREETER, ROBERT T. SWAINE, THOMAS W. SWAN, ALFRED H. SWAYNE, HOWARD P. SWEETSER, W. B. SYMMES JR., ANSON W. H. TAYLOR, WM. A. TAYLOR, JR., WARD E. TERRY, JAMES A. THOMAS, HENRY VARAY, EDWARD WASSERMANN.

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Reverend W. G. DOUSLEY.
Professors WALTER G. CADY, HARRISON HARLEY, TAMIJI KAWAMURA, RODNEY A. SLAGG.
Doctors HAROLD L. AMOSS, EDMUND BARRY, G. GRANVILLE BUCKLEY. LEO BURTHE, LEONARD FREEMAN, W. BRUCE LARGE, MALCOLM DEAN MILLER, THEODORE S. MOISE, FREDERICK B. NOYES, H. M. OGILBEE, HIROSHI OHSHIMA, DALLAS G. SUTTON, CARL WIEDENMAYER.
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